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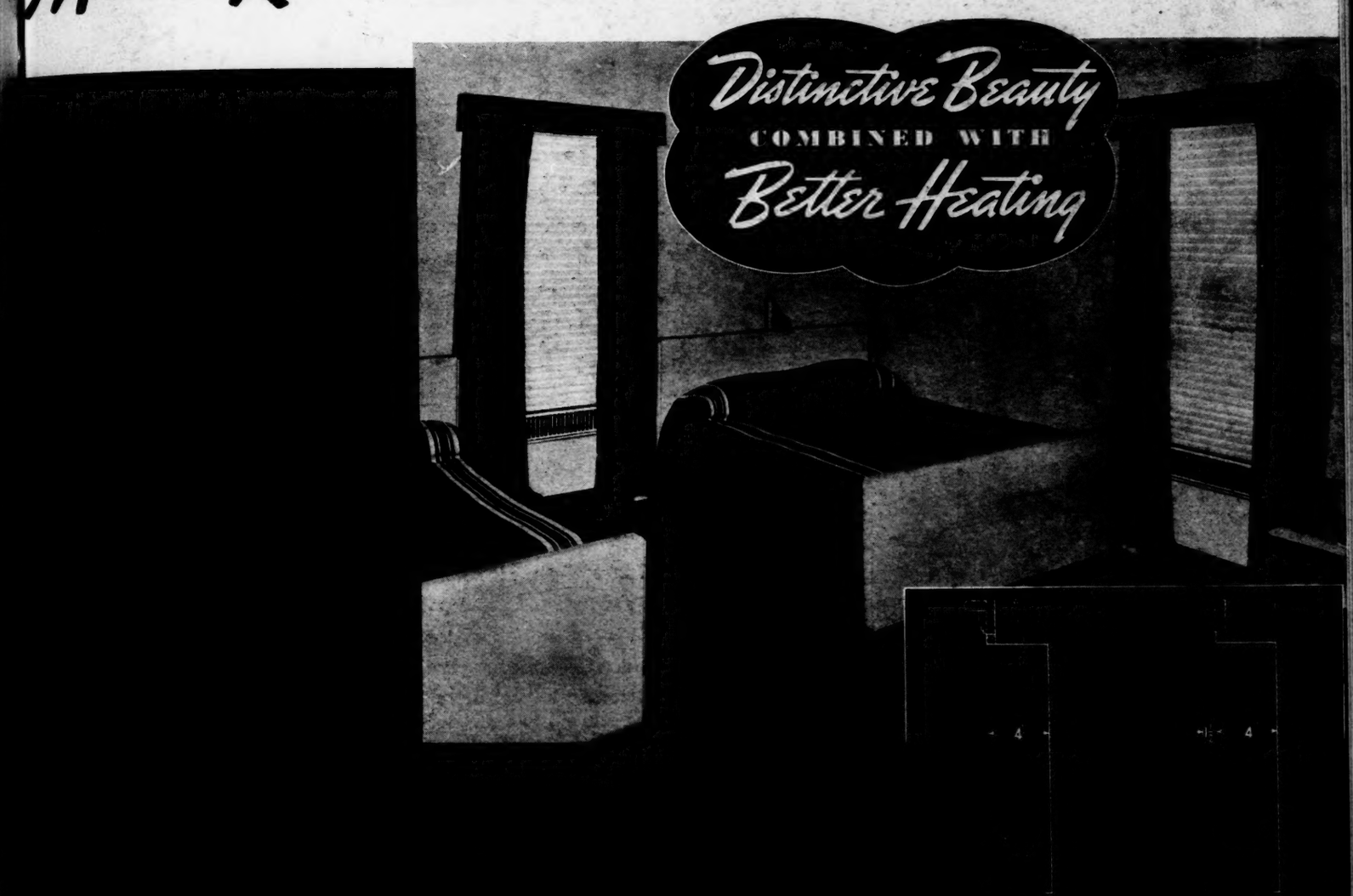


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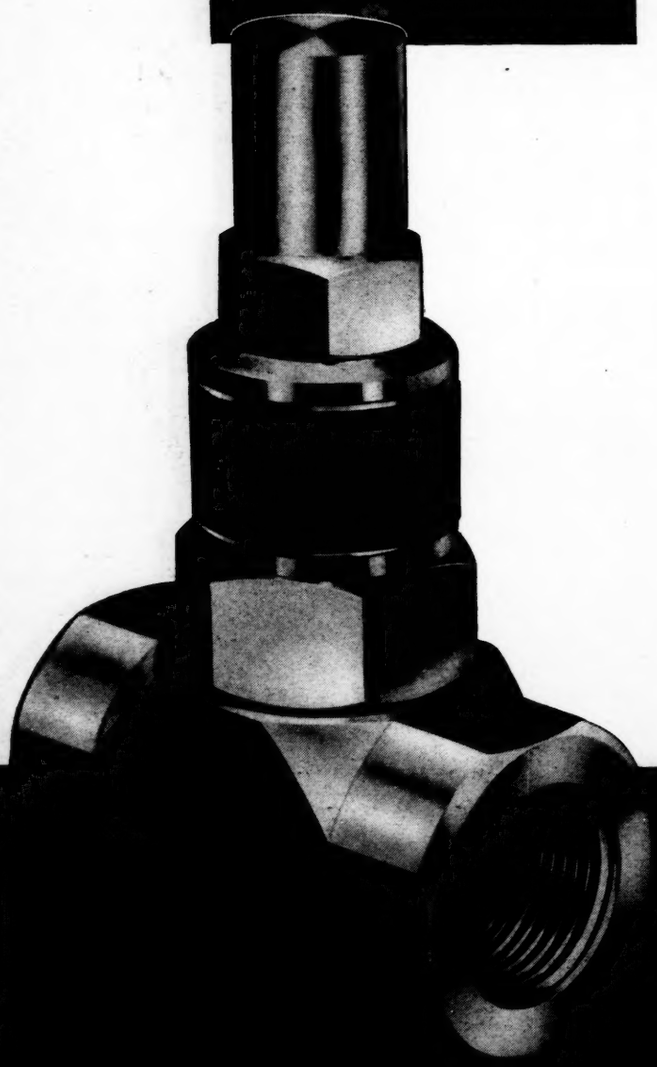
LEE of Conshohocken Tires

# 57 YARWAY IMPULSE TRAPS



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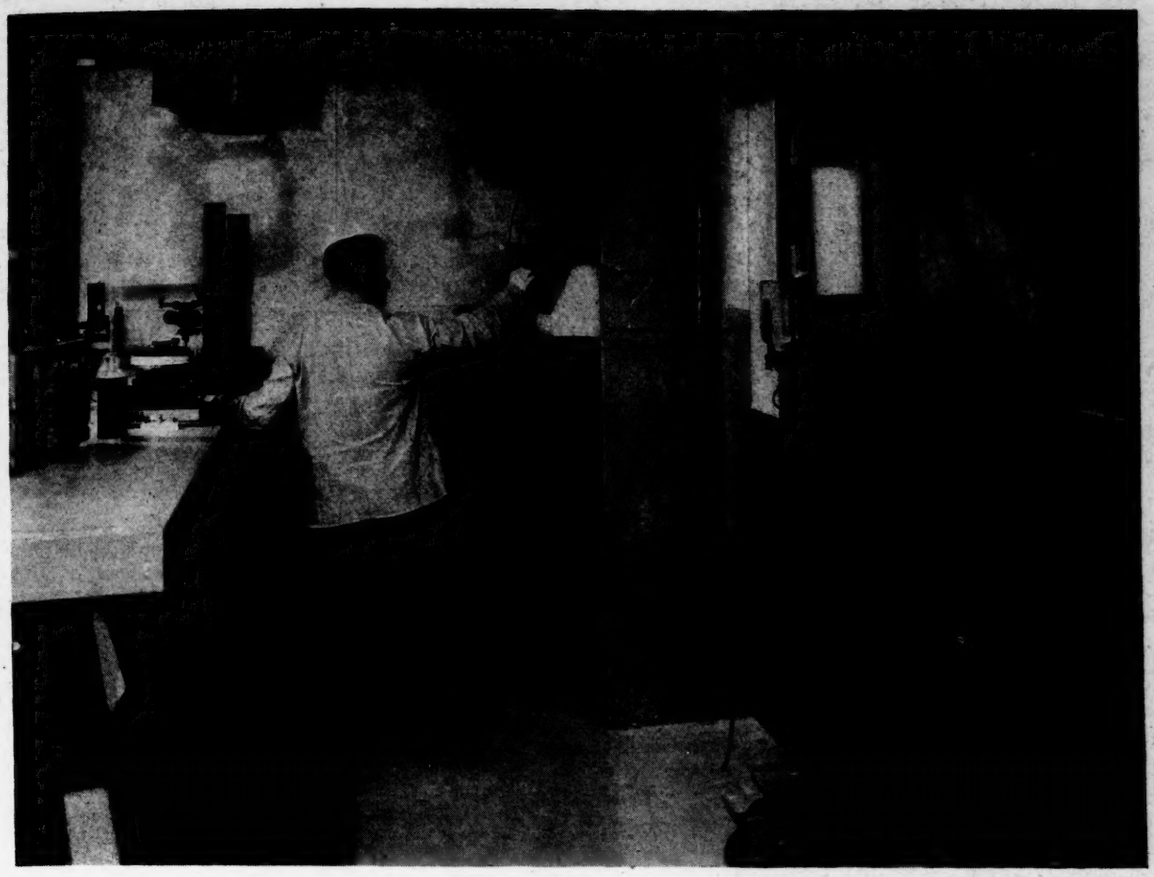

*View of the operating control room at the Forest Products Laboratory.*

# New Test Plant for Heat and Moisture Transmission

By M. E. DUNLAP†

RECENT developments in heat insulation and humidification in homes have intensified several problems in building construction. One which is giving considerable concern at the present is that of condensation of water in walls and attics of well-insulated houses, particularly in regions of severe winter climate. The extent and seriousness of this problem are not adequately known at this time.

The Forest Products Laboratory has been actively studying this problem and is approaching it from several directions. Part of the work consists of experiments on wall sections exposed to winter indoor living conditions on one side and winter outdoor conditions on the other. To make possible the continuous measurement of the heat and water vapor losses and the temperature and moisture gradients through the wall, it was necessary to develop a new method of test and to construct a new and unique testing plant.

It is the main purpose of this article to describe this apparatus which has been under development and use during the past year. The apparatus includes new features not found in previous work bearing on the insulating value of wall construction. The guard ring principle is used, but the operating room is conditioned, thus eliminating the necessity of a secondary enclosure and making it possible to use a large sample wall.

Two adjacent rooms subject to temperature and humidity control are used. One of these is normally operated at a temperature of 72F and 40% relative humidity, and the other at as near zero F as possible. In the wall between the two rooms are two large openings for two test panels.

Fig. 1 shows two test panels in the openings in the walls. Against the center area of the inside face of each panel is placed a compartment or measuring enclosure within which the temperature and humidity are automatically controlled and kept at the conditions in the operating room, so that there is no tendency for heat or moisture transfer between the room and the measuring enclosure. Thus all the heat and moisture supplied to this measuring enclosure can be accounted for as passing into or through the test wall area cov-

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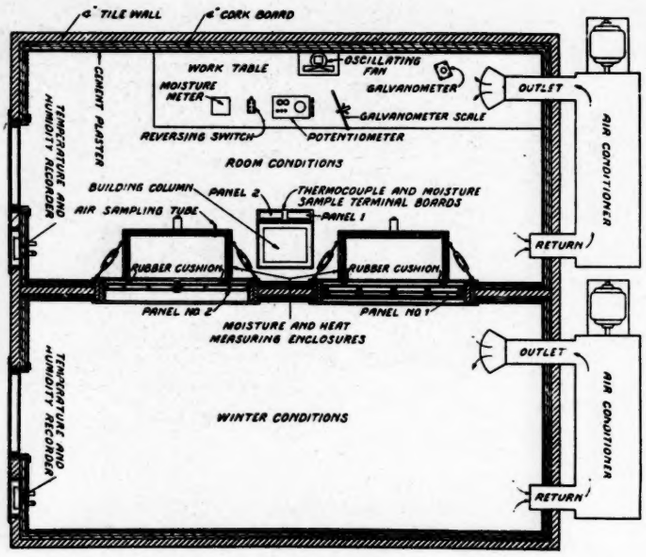



*Fig. 1. General arrangement of wall section and apparatus.*

ered by the enclosure. The enclosures are composed of corkboard walls, lined with plywood inside and out, and made resistant to moisture transmission by three coats of aluminum paint.

The purpose of this form of construction is to minimize the effects of any slight differences that might exist between the conditions in the enclosure and those in the operating room. The enclosure is drawn firmly against the face of the test panel by means of four turnbuckles and the joint is made tight by a soft rubber gasket.

Measurements of temperatures within the wall and at both surfaces are made with thermocouples. Enough of these are used to permit the determination of the important points on the temperature curve throughout the entire cross section of the wall. The thermocouple locations are shown in Fig. 2. All thermocouple leads are brought to a terminal board so that connection can be readily made to a potentiometer.

An analysis of the conditions in a wall subjected to low temperatures on one side and normal room temperatures on the other indicates that during cold months the wood parts vary in moisture content. Wood lath on the inside of the wall remains quite dry, whereas the sheathing may become very moist due to the high humidity or condensation of moisture on its surface.

Accordingly, to make moisture content determinations, electrodes are installed in the wood itself and in blocks in the air spaces as shown in Fig. 2. These electrodes consist of two pairs of brass escutcheon pins driven to a depth of ¼ in. into the material to be measured. Each pair of electrodes is wired together, one pair being connected to a common lead to the switchboard and the other pair to a numbered socket on the switchboard. In this way any sample may be connected into the circuit and the moisture content measured with an electrical moisture meter of the resistance type. While this method of making moisture determinations is normally an accurate one, it must be used with discretion. Moisture condensing on the surface of the wood at the electrodes tends to short circuit them and to give a reading in excess of the average moisture content of the wood. Corrections are applied where measurements are made at low temperatures in order to compensate for the variations in the resistance of wood with temperature. At the completion of a test run the wall panel is cut up and moisture samples taken. Moisture determinations are made on the samples by the standard oven-drying method.

The temperatures inside the two rooms are controlled by standard pneumatic instruments and the details of the control system need not be discussed here.

The temperature-sensitive element within the measuring enclosure consists of brass wire so arranged that small changes in length produce a relatively large movement of the contact points. This arrangement actually affords a sensitivity of two- or three-tenths of one degree Fahrenheit.

An electric current, which is controlled by the opening and closing of the contact points, operates a relay through a vacuum tube circuit. The current actuating the relay is so small that no corrosion occurs at the contact points, and good sensitivity has been maintained throughout tests of several months duration. This thermostat controls six electric heating coils, connected in series, which supply only a small part of the heat. The bulk of the heat is supplied by an electric fan and an electric light bulb that operate continuously, but they do not supply enough heat to maintain the

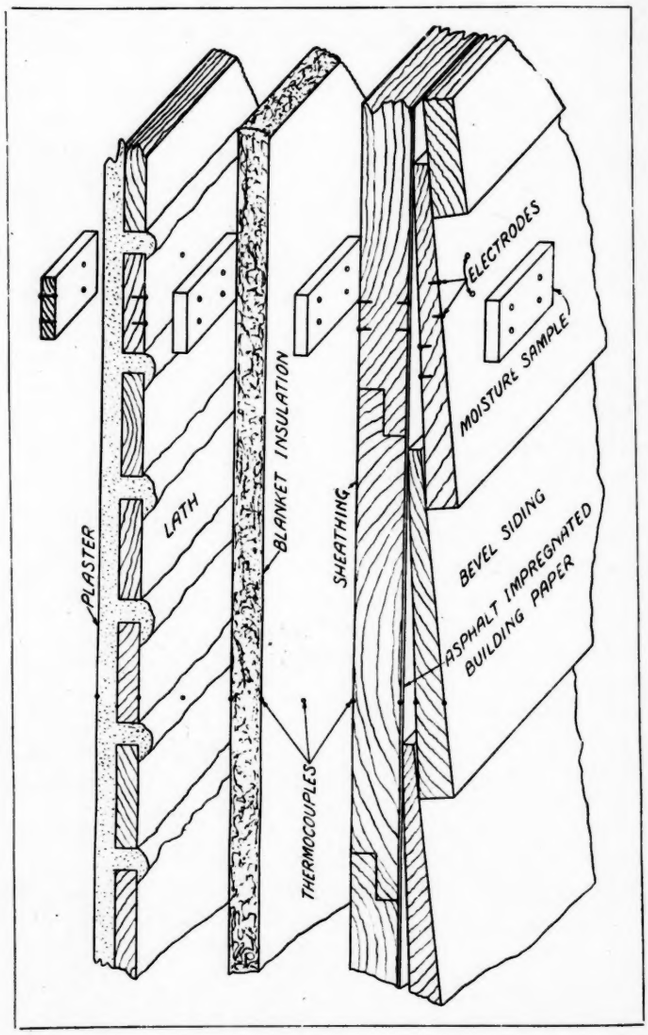



*Fig. 2. Stud wall section showing thermocouple and moisture sample arrangement for gradient measurements.*

proper temperature level. A small amount of heat is added through the occasional operation of a motor-driven humidifier. The heat required to evaporate the water used in humidifying is very small compared with the total amount of heat used and may be neglected.

The heat quantities in each enclosure are measured by means of a watt-hour meter sensitive to one watt-hour. All electrical energy supplied to the interior of the enclosure passes through this meter and is converted into heat.

One of the novel features of the apparatus is the method used in humidifying the space within the measuring enclosure and obtaining an accurate record of the amount of water evaporated. This amount is the amount of water vapor lost from the enclosure. See Fig. 3.

Whenever the humidity in the enclosure drops slightly the motor of the humidifier is automatically turned on and rapidly rotates a wet brass drum causing water to be evaporated from its surface. The water supply to this evaporator comes from a calibrated glass tube outside the enclosure and is fed to the drum face by a sponge wick. The calibrated tube is normally in a nearly horizontal position. When, however, it is desired to read the level of the water in the tube or to add water, the hose clamp is put on the rubber tubing and the glass tube is elevated to the vertical position. Normally the water supply does not need to be replenished oftener than once a day.

The humidity within the enclosure is controlled by means of a hygrostat, the moisture-sensitive element of which is a band of goldbeaters skin, and connected into the control circuit. The electrical part of the control system is the same as that of the temperature control system. The relay controls the current to the humidifier motor. A sensitivity of a few tenths of a per cent of relative humidity is obtained.

A tube is provided for sampling the air inside the enclosure in order to check the relative humidity. Air is pumped past a hygrometer, or dewpoint instrument, to make this determination.

The general view of the operating room included in the opening illustration in this article shows, at the left, the moisture meter used in making moisture measurements and, at the right, the potentiometer used in recording temperatures. The switchboard for moisture meter wires and thermocouples is shown at the center of the picture and one of the measuring enclosures at the right-hand side. The watt-hour meter and temperature and humidity recorder are shown on the side of the enclosure. The type of water supply to the humidifier shown has been replaced by the arrangement shown in Fig. 3.

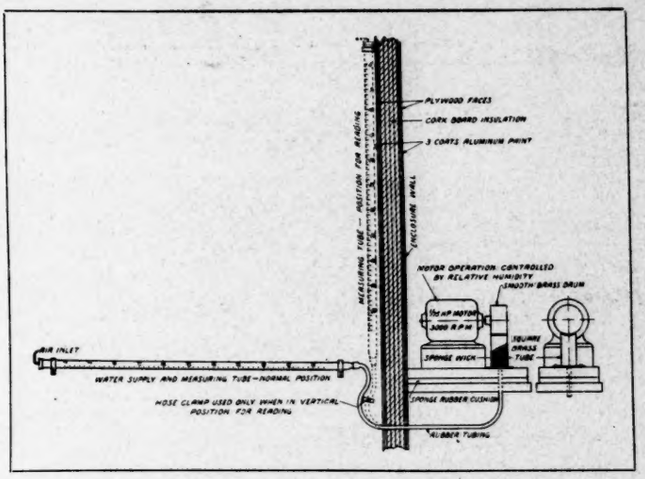



***Fig. 3. Evaporation recording humidifier.***

The thermostats, hygrostats, humidifiers, vacuum tube relays, and temperature-humidity recorders are all special pieces of equipment designed and developed for this application and made at the Forest Products Laboratory. The potentiometer and the moisture meter are standard commercial products.

Several runs have been made on new wall constructions and more tests are planned for conventional wall construction, wherein factors influencing moisture condensation and methods of preventing its occurrence by barriers and ventilation will be studied. It is hoped also to apply this study to farm buildings, particularly barns, which are subject to condensation difficulties also, especially in the northern states. The data will be made available to the public for practical applications as the work proceeds. Parts of it will appear in an early issue of HEATING & VENTILATING.

## Wetter Water

CHEMISTRY'S latest miracle was announced to the American Chemical Society at Rochester by B. G. Wilkes, of the Mellon Institute of Industrial Research, Pittsburgh, and J. N. Wickert, of the Carbide and Carbons Chemical Corp., West Virginia.

A new synthetic alcohol added to ordinary water, they stated, makes it "wetter"—that is, whatever the water touches it wets almost instantly. Yarns that would take many minutes to become wet through with ordinary water, become soaked in a few seconds with "wetter water."

Outstanding and probably most useful from the point of view of health among the properties of the discovery, is its capacity for laying dust.

Describing an experiment, Mr. Wilkes said that an ordinary water spray fell through the air of a room hazy with dust without effect.

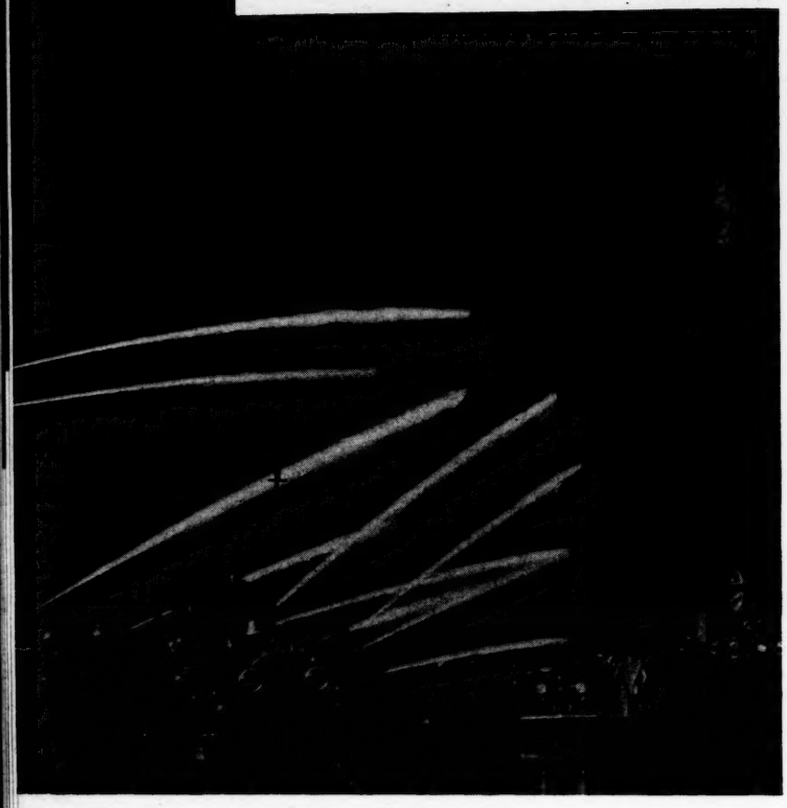
Wetter water, however, made the air almost entirely clear and solved the health hazard. The wet water simply soaked instantly every dust particle it touched, where ordinary water drops had been glancing off.

This should be a great aid to air conditioning, as the fine sprays of ordinary water used in spray chambers should be made much more efficient through the use of this substance.

Wetter water also enhances the deadliness of most insect sprays.

Old wallpaper starts peeling when touched by wetter water. The substance is also a good remover of the poisons left on fruits from insect sprays.

# Fire Alarm Building in Boston Is Completely Air Conditioned



RECENTLY completed in Boston is a handsome new building for the Boston Automatic Fire alarm Company. Equipped with complete air conditioning, it is the first commercial building in Boston in which the air conditioning equipment is an integral part of the structure.

The system provides heating, humidification, dehumidification, cooling, air filtering, and circulation, with automatic controls. It is adapted for both winter and summer comfort and has dual thermostats all through, for use by occasional night workers in the various offices who may wish different conditions after regular office hours.

Of fireproof construction, with steel frame and concrete floors, the building houses automatic fire alarm equipment which protects some 400 buildings in Boston with a total value of two hundred million dollars. When the time came to move from the former quarters to the new building, the throwing of a switch accomplished the passing of the signal and alarm service from the old system to the new one.

Direct heat losses are cared for by convectors placed under windows, all controlled by dual thermostats. The main thermostat controlling all the duals is so constructed as to set the entire system on a day or night peak by means of a program clock. At a predetermined time all thermostats are cycled to the night, or lower temperature setting, while in the morning, at any selected time, the thermostats are automatically reset for the day temperature range.

If, however, a tenant wishes to use his offices at night, after the night control has been established, he may, by pushing a button on any thermostat in his rooms, reset his offices to the day range and thus establish the same comfort conditions as prevail in the daytime, insofar as the heating is concerned. In summer the "stand by" loss is so minimized by the building construction that the daytime cooling effect will continue for a considerable period in the evening.

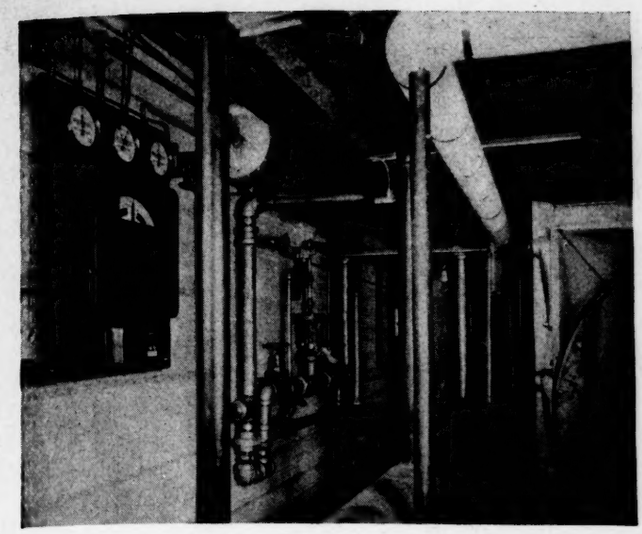
During that part of the year when heating is not required for comfort, steam can be shut off in the air conditioning coils and in the risers throughout the building. Steam is available, however, to heat the service hot water and at the same time is available for instant use if the weather turned suddenly cold.

Gross cubic contents of the building are 26,550 cu. ft. and net amount of conditioned air supplied totals 22,640 c.f.m. Outside air is drawn through an intake at sidewalk level in the rear of the building and totals 3500 c.f.m. Air is circulated in sufficient volume to give a complete change every ten minutes. The supply air is greater in volume than the return air, so that a pressure is established in each room, this to a large extent overcoming the infiltration around windows, and allowing outside air to enter only through the outside air intake, where it is filtered. The intake was placed at sidewalk level owing to lack of space to extend it upward to the roof. However, the discharge is at the roof.

If the return air enters the ducts at a higher than the pre-set temperature, a thermostat operates a damper in the supply duct and cuts down the amount of heated air, while also operating a valve on the heating coils to cut down the steam supply. The thermostats also shut off the convectors until the desired room temperature is reached. Besides the usual automatic controls there is installed an automatic protective system in case of fire or smoke.

The building itself is guarded by the Aero system which is a part of the company's own protective de-

**The first commercial building in Boston in which complete air conditioning equipment was provided as an integral part of the new building is that of the Boston Automatic Fire Alarm Company described here and shown to the right. The system provides heating, humidification, dehumidification, cooling, filtering ,and circulation. In addition, if there is a fire in the building, dampers are closed and blowers are stopped by means of an automatic fire control. Photo above by Galloway.**



*(Left) A view in the machinery room. At the left is the program clock for day and night setting. In lower center the control for the condenser water, and in the right background the filter chamber. (Right) The 30-ton refrigerating compressor. Indoor temperatures are maintained at 72-80F regardless of outside temperature. A circulating pump provides cooled water at 55F for drinking purposes.*

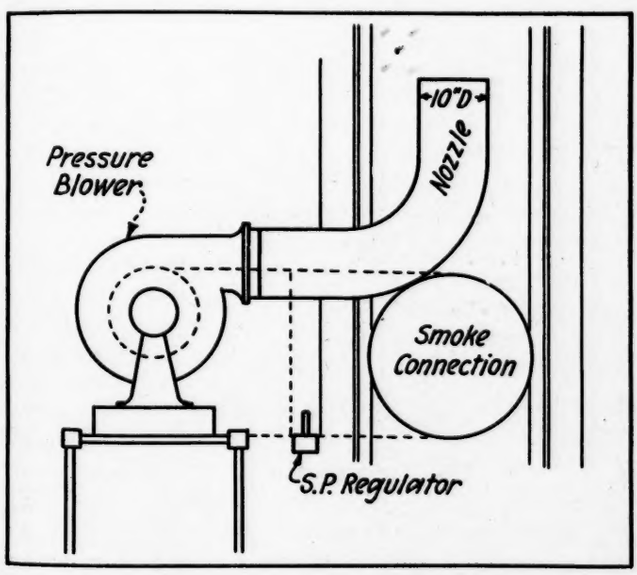
vices. If a signal comes through the Aero that there is trouble inside the building or if a fire outside fills the vicinity with smoke, a button in the central station operates to close the main dampers in both supply and return ducts and shuts off the electric current to the fan so that no air circulation may carry smoke from one room to another. Also the excessive heat, which causes the alarm to function, if the trouble is inside the building, would automatically close the dampers to that part of the building and isolate it from the rest of the building. These dampers would open automatically as soon as normal conditions again prevailed, but the fan and main dampers would have to be reset by hand.

Blackall, Clapp & Whittemore, were the architects, and Charles H. Whittemore of that firm designed the engineering of the building.

## Use of Blower Permits Low Chimney

MOTORISTS on New York's West Side Highway recently have noticed a new sign "Chevrolet" and a large clock. It stands on the roof of the trucking transfer station of the Consolidated Motor Lines, Inc., 23rd Street, west of Eleventh Avenue, and when the sign contract was made, it was stipulated that no obstructions be permitted above the roof level.

A one-story building, the chimney was therefore limited to 26 ft., whereas the figured minimum height was 45 ft., and the boiler manufacturer wanted 60 ft. A low pressure steel firebox boiler was specified with a resistance of 0.1 in. of water and fired with a horizontal rotary oil burner using No. 5 oil.




*Arrangement of blower to provide induced draft.*

It was feared that the draft would be insufficient so an induced draft fan was installed. This fan was a pressure blower designed to deliver a jet of air against a static pressure of ¾ in. and of sufficient volume to maintain 0.13 in. in the stack below the fan outlet.

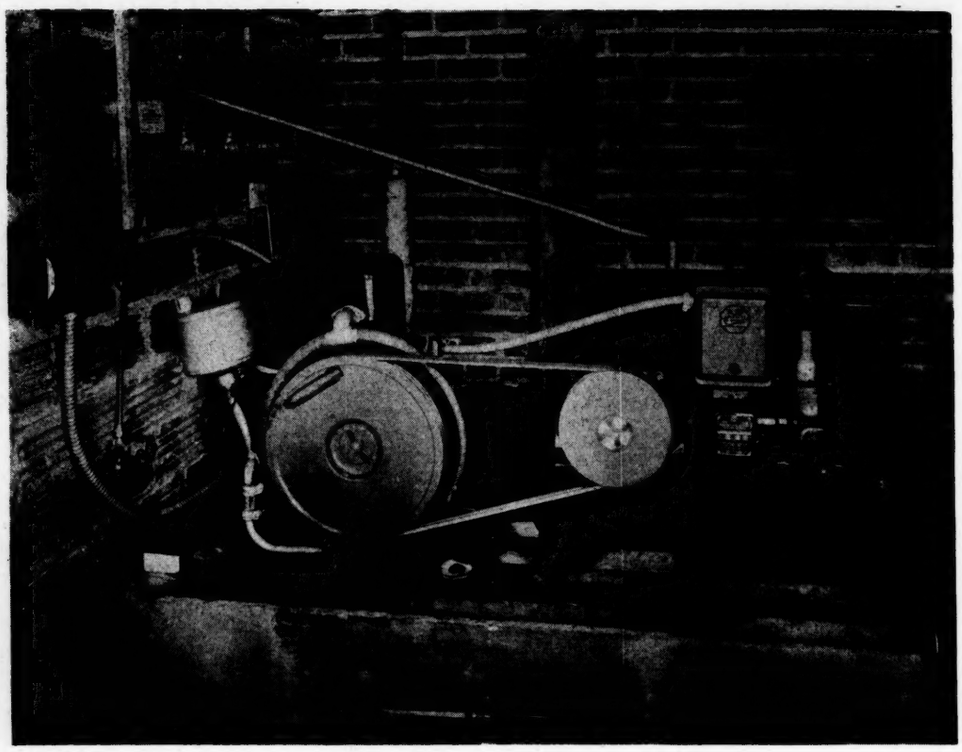
No restriction was made in the chimney area except that caused by the nozzle which was extended the full size of the blower outlet and turned up, being made of 10 in. dia. welded pipe and elbow and solidly bolted to the blower.

The control system is such that when any thermostat in the building calls for heat, both blower and oil burner motors start together, the lag in the burner before combustion enabling the blower to pick up pressure. A static pressure regulator shuts off the blower at 0.13 in. static pressure and the burner fan is then sufficient to keep up draft.

In practice it has been found that the blower is not required in cool weather, its principal service to be in the summer when the boiler is used only for hot water.

It is possible that other low buildings may be made available for advertising purposes by this method.—*Bret Harte Whitman, Jr., Consulting Engineer, New York, N. Y.*

# Gas Engines for Air Conditioning



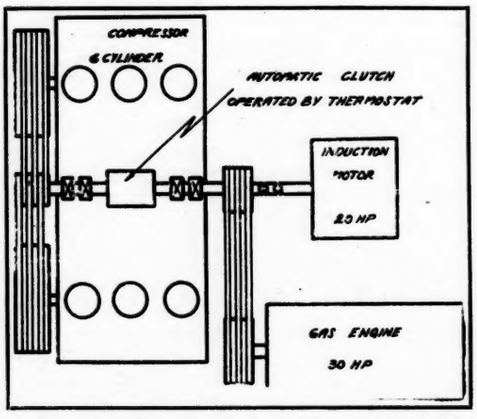
*One of the first installations of a gas-engine-driven refrigeration compressor and motor generator.*

IN a number of instances the owners of air conditioned premises have changed the motive power of their plants from electric motors to gas engines. In districts where natural gas is available this usually results in a considerable reduction in the cost of power. However, gas utilities are at a disadvantage in urging this change because of the fact that gas engines cannot carry any appreciable overload for even a short period without stalling. Consequently, the size must be determined by the maximum load (no matter how slight its duration) which may reasonably be anticipated. This means that in most cases the engine is carrying less than rated load for 90% of the operating time, thus exacting penalties in the form of lowered efficiency and higher first cost.

A method of overcoming this disadvantage and making it possible to run the engine under full load practically all the time was reported on recently by Ralph S. Wenner of the Ohio Fuel Gas Company before the National Conference on Industrial Gas Sales in Chicago. This method consists of simply hooking the gas engine on to the existing electric motor and allowing the equipment to run exactly as before. Abstracts from Mr. Wenner's paper follow:

Briefly, here is the underlying theory. A gas engine and a mechanical load are both connected to an induction motor or what may better be termed an induction machine, since only at certain speeds is its behavior that of a motor. For any such induction machine there is what is known as its synchronous speed. When it operates as a motor it revolves at a speed slightly less than this synchronous speed. The more heavily loaded as a motor, the slower its operating speed, although the lag seldom exceeds 10% of synchronous speed for small motors or 5% for large motors.

If by the application of power to the motor shaft the motor is caused to rotate at its synchronous speed, it, for all practical purposes, is no longer receiving power from the supply lines. In the case described the gas engine will be driving the mechanical load through the motor as a jack shaft. The motor will be merely idling. If the speed of the system is further increased by increasing the engine speed, the induction machine will become an induction or a synchronous generator.




*Schematic diagram for a gas engine drive of a six cylinder refrigeration compressor.*

To perform this function it is dependent upon the line voltage for excitation. The voltage and frequency which it generates are exactly the same as that of the supply line, so that it is suitable for use by any other equipment connected to the line. Even in the event that part of it should find its way back through the meter into the neighboring distribution system it could do no harm. It is

completely identical with the supply, is dependent upon it for functioning, and fails when it fails.

Through the use of this plan you can take each separate case that you may have for consideration, decide how much of the load you must take to make for maximum return on the investment, and make your application accordingly. It allows perfectly for the flexibility, both for application and operation for which we have so long been looking. Diesel manufacturers are proud to advertise that their installations may be amortized in three years. They have built up a large business on this fact. Yet you will find that this plan will usually provide for amortization in from twelve to eighteen months and at gas rates that are satisfactory.

The customer makes a greater saving per dollar of investment than can be made through any other plan for several reasons. First, he can install and use an engine approximately twice as large as would be possible if only the mechanical load were considered. He installs an engine capable of delivering this mechanical load plus an electric load equal to the capacity of the motor as a generator. His initial cost per horsepower is reduced.

This initial investment per horsepower is further reduced because he need not apply a safety factor for possible overloads. The electrical system cushions this. Also in most cases he needs just a simple gas engine without starting equipment, clutch, or other auxiliaries.

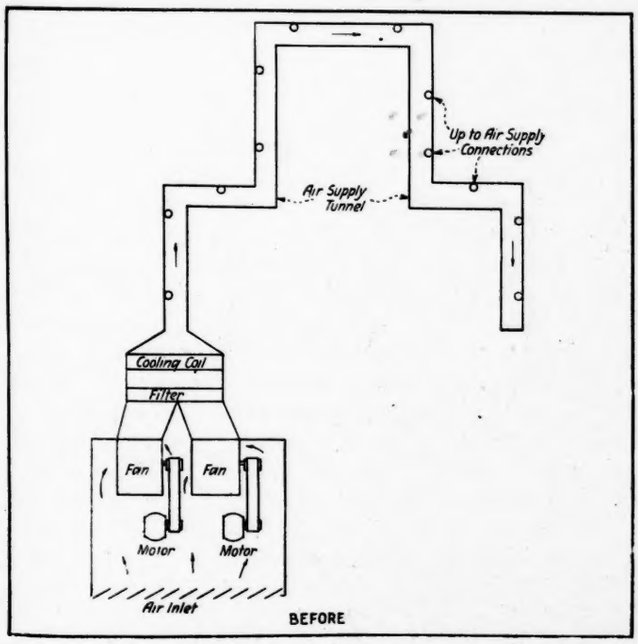
He makes an operating saving because in the normal application, he is operating always at constant full load. Let the mechanical load drop off and our system reaches out and takes a compensating electrical load. Let the mechanical load pick up and we drop an exactly equal electrical load; and we do this literally at lightning speed, and with no control devices. The control is inherent in the system itself. It involves only very slight change in speed. Further than this there is no problem of acceleration to impose its penalty of higher fuel costs. This fact of constant full load operation, for most installations, will bring to an operating reality the best economies that the manufacturers can build into their engines.

A further advantage is that we don't disturb, remove, or replace any existing equipment—we merely supplement it. They still have an electric motor connected to their load and hooked up with central station service. If the gas engine fails the wheels keep turning just the same. If they have automatic controls installed, we don't disturb them. Without touching them, we may apply them to our engine through the motor. We eliminate the fear, warranted in the customer's mind, of cutting away from utility service and we don't introduce line shafts, at least not mechanical line shafts. Perhaps it is proper to consider that we have introduced a flexible electrical line shaft into the gas engine picture.

# Rearrangement Corrects Faulty Air Distribution

A LARGE church building having a seating capacity of some 1500 people was provided with two 6000 c.f.m. pressure fans for the distribution of the air from the outside of the building through filters, through the free spaces of direct cooling coils for heat transfer and vapor elimination, and thence to a 4 ft. by 4 ft. air tunnel. This air tunnel was constructed in the lower section of the church and extended along the inside surfaces of the foundation walls of the sides and the front of the building, as shown diagrammatically in Fig. 1.

Twelve small circular openings were provided in the concrete floor of the main sections of the church to connect the top of the air tunnel with chambers constructed in the side walls of the seating section of the church. Fig. 3 (Before) illustrates the way the air from the tunnel reached the room through grilles. These cham-



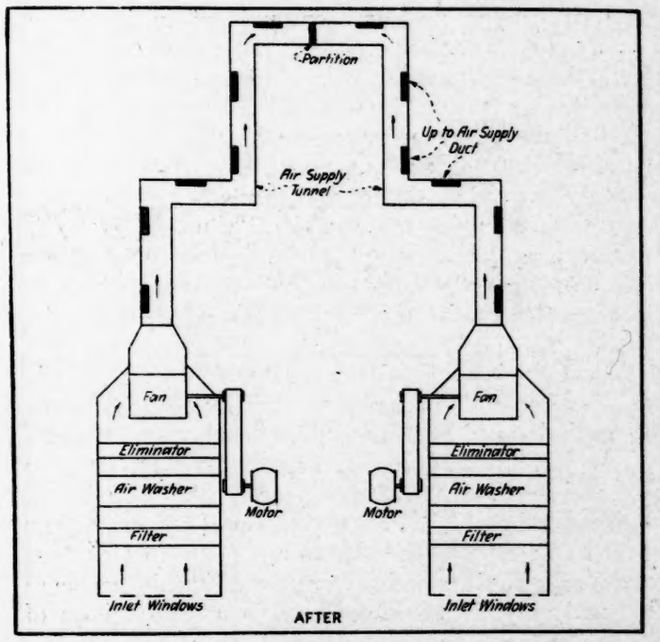




*Fig. 1 (Left). Original air supply connections, air tunnel, and equipment of church building. Fig. 2 (Right). Rearranged and new equipment, air supply ducts, and air tunnel installations.*

bers, providing space for the installation of radiators, were lined inside with sheet metal, while their lower front section was covered by cast iron grilles. This same sketch also shows how an air passageway was formed within each chamber whereby the air from the tunnel could pass out of ornamentally grilled 2 ft. x 6 ft. openings on the sidewalls 8 ft. above floor level.

This air handling system had full capacity air volume from the outside of the building and exhaust was provided through the ceiling as well as through outleakage by way of door and window openings.

This air conditioning and distribution system failed to provide the conditions thought to be necessary. The designers and the operating personnel applied many variable operating conditions without securing the desired results, and operation of the system was soon abandoned.

The writer had the privilege of observing this system following the completion of the construction, installation, and operation for a test period, and after studying it came to the conclusion that the operating difficulties could be corrected by fairly simple means. The principal changes are shown in Fig. 2 and in Fig. 3 (After).

As indicated in Fig. 2, the air tunnel should have a partition wall constructed at the front section to provide equal length for each distribution duct. The two separate air tunnels thus formed should be connected directly to the discharge openings of the fans. The fan connections to the air tunnel should have an opening with doors for the inspection and observation of the equipment and the tunnels. The air washers for each section should have the housings constructed to provide direct connection to the inlets of the fans. The air filters are shown located at the inlet for the outside air and are provided to maintain air cleaning during periods when the air washers are not in operation and when the load condition set up a ventilating requirement for the occupancy. Motors, belts, and bearings are located to avoid direct flow of raw air in order to eliminate frequent cleaning and rapid deterioration of the equipment.

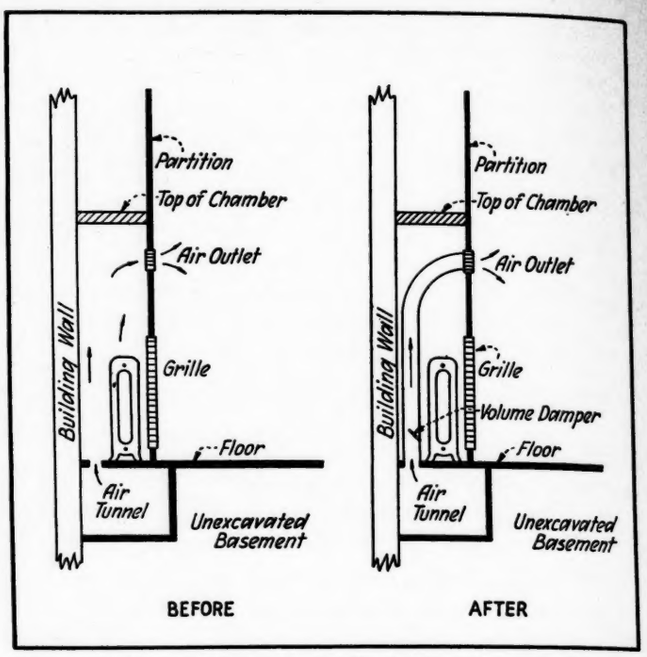



*Fig. 3. Left—original air supply duct and connections to the air tunnel; right—correct air supply duct and connections to the air tunnel.*

The air supply chambers illustrated in Fig. 1 were rearranged as shown in Fig. 2. The connecting openings between the air tunnels and the supply chambers in the walls were increased from the original sizes of 3 in. diameter circular openings to 10 in. x 42 in. rectangular openings. A volume damper should be installed in the interior of the air passage for the control of the air volume as necessary.—*Thomas J. Brett.*

## Heating a Large Floral Conservatory

THE heating problems encountered in heating a floral conservatory or greenhouse are quite different from those encountered in heating an ordinary building. Owing to the high rate of heat transmission through the glass enclosure, the heating system must be capable of quick response to the demands for extra heat during nights, cloudy and cold days, and particularly when a sudden cold wind springs up. The heating system must also respond quickly to the demand for less heat when the heat from the sun's rays tends to increase the interior temperature beyond the point desired.

When the large floral conservatory for Forest Park, St. Louis, was planned, careful consideration was given to the design and selection of a heating system. Because of the large size of the building (see picture on page 38) and because of its location on the top of a hill, it was decided to use a vacuum system of steam heating. Two boilers were installed, one of the oil-burning type and the other of the hand-fired coal-burning type to be used only for emergency use in case of failure of other boiler.

A double line of wall hung radiators was suspended on the masonry walls. A recent test shows that excellent distribution of heat is obtained in this building. On January 31, 1938, the temperature outside of this greenhouse was 6F above zero. Measurement inside the greenhouse showed a temperature of 64F at the floor, and only 68F at the ceiling which is 51 ft. above the floor. This even temperature was attributed to two factors; namely, the design of the greenhouse with the horizontal roof surfaces distributing the heat, plus the fact that holes were drilled at the sill of each roof level to take care of condensation. These holes are approximately ½ in. x 1 in. and are on 5½-in. centers. The infiltration through these holes just about offsets the tendency for higher temperatures at higher levels.

The temperature is controlled automatically to main tain a temperature of 65F at all times. The humidity is taken care of by normal watering of the plants. Heat losses were calculated on the basis of 55F in zero weather. The total B.t.u. loss was figured at 1,300,000.

The heating system was designed by John C. Ross. mechanical engineer, under the supervision of William C. E. Becker, chief engineer of bridges and buildings, City of St. Louis.

# Detroit's Climate—Its Relation to Seasonal Cooling Load

By L. W. JILLSON and P. S. HOSMAN

**In Detroit, Mich., there are records available of hourly readings of dry and wet bulb temperatures for the past seven years as well as other data important to the designer of air conditioning systems. These data can be put to use in many ways and are well worth careful study when plans for any type of cooling, either for comfort or process, are contemplated. Extreme conditions govern the capacity of the cooling system while the average conditions have the most influence on the seasonal cost of cooling. Presented here are both average and extreme conditions for this locality together with an illustration of how these data may be used.**

**The authors are mechanical engineers engaged in air conditioning design with the Detroit Edison Company.**

THE weather conditions in any particular locality have a great deal to do with the design and operation of an air conditioning system. The exact amount of variation in load due to changes in weather depends upon the character of the load and the system used. In all cases the outdoor air used for ventilation as well as that which enters the room by infiltration affects the load, at times increasing, at others decreasing it. When the space to be conditioned is exposed to radiant heat from the sun and to conducted heat through its walls, windows, roof, and floor, a large part of the entire cooling load may be due directly to the weather conditions. There are, however, certain parts of every cooling load which are affected very slightly or not at all by changes in outdoor temperatures. An electric light bulb or stove, for example, will give off precisely as much heat with the outdoor temperature at 100F as it will when the temperature drops to 50F outside as long as the space temperature remains the same. Likewise, the amount of heat given off by the occupants and whatever other sources of heat there are within the space may be considered as being constant insofar as the outdoor conditions are concerned.

One of the first steps in the design of an air conditioning system is the decision as to just what outdoor temperatures will be considered as being the maximum. Obviously, the highest combination of dry and wet bulb temperatures on record would not be the correct one to use, but it would be proper to use a value which is not often exceeded and to then depend upon margins in other parts of the load when the design conditions are exceeded for a short space of time.

The fact that an air conditioning system is designed for a certain maximum capacity does not mean that it will always be operated at that capacity, rather that it should never be operated at a higher rating. The load will vary, then, from the design rating downward to zero. That variation will be continuous. The entire range may be traveled within a few hours and at another time the load may remain practically constant for several days.

In an effort to establish a suitable design point and to forecast probable daily and seasonal loads, a comprehensive study of local Weather Bureau records has been made.

### Detroit Weather Records

Records of general weather conditions have been kept at Detroit since 1871. The uses, however, to which a general record can be put are limited to the establishment of extreme and mean values and are not given in enough detail to permit the working out of a load schedule.

Since February, 1934, the official weather data have been observed at the Detroit Airport and, beside the regular airport observations, dry and wet bulb temperatures were read and recorded hourly. Prior to that time similar data had been taken at the Wayne County Airport although these were not entered in the official weather reports. Table 1 gives data abstracted from the official log sheet of the Detroit Airport for July 20, 1934. This will be referred to again for it happens to come the nearest to being a perfect "design day" of any day on record.

TABLE 1—DETROIT WEATHER CONDITIONS DURING AN EXTREME SUMMER DAY

| Local Time | Sky Conditions | Wind Direction and M.P.H. | Temperatures | | |
|---|---|---|---|---|---|
| | | | D.B. | W.B. | D.P. |
| 12:42 a.m. | Hi,Br. | SSE, 4 | 76.0 | 70.0 | 67 |
| 1:42 | Sc. | SE, 3 | 75.2 | 69.8 | 67 |
| 2:42 | Sc. | ENE, 7 | 73.0 | 70.0 | 69 |
| 3:42 | Sc. | ENE, 12 | 73.0 | 70.0 | 69 |
| 4:42 | Sc. | ESE, 3 | 72.2 | 69.8 | 68 |
| 5:42 | Hi,Sc. | N, 2 | 70.6 | 69.0 | 69 |
| 6:42 | Sc. | NNW, 4 | 71.8 | 70.0 | 69 |
| 7:42 | Hi,Th,Br. | N, 2 | 76.1 | 71.7 | 70 |
| 8:42 | Hi,Th,Br. | NW, 2 | 81.1 | 73.1 | 70 |
| 9:42 | Hi,Th,Br. | NE, 6 | 85.2 | 74.0 | 69 |
| 10:42 | Hi,Th,Sc. | SE, 4 | 89.8 | 74.8 | 69 |
| 11:42 | Th,Sc. | E, 5 | 90.2 | 73.8 | 66 |
| 12:42 p.m. | Sc. | ESE, 5 | 92.2 | 74.1 | 66 |
| 1:42 | Sc. | NE, 5 | 93.3 | 74.4 | 66 |
| 2:42 | Sc. | SE, 6 | 93.5 | 75.0 | 68 |
| 3:42 | Sc. | E, 10 | 95.0 | 75.0 | 66 |
| 4:42 | Hi,Sc. | E, 6 | 94.3 | 75.2 | 67 |
| 5:42 | Hi,Sc. | E, 12 | 93.9 | 74.5 | 66 |
| 6:42 | Hi,Th,Br. | E, 6 | 92.0 | 74.7 | 67 |
| 7:42 | Hi,Sc. | E, 4 | 89.0 | 74.8 | 69 |
| 8:42 | Hi,Th,Sc. | NE, 10 | 83.4 | 74.8 | 71 |
| 9:42 | Hi,Th,Sc. | NE, 8 | 81.0 | 73.4 | 71 |
| 10:42 | Hi,Th,Br. | NNE, 9 | 79.3 | 72.9 | 70 |
| 11:42 | Hi,Th,Sc. | NNE, 8 | 77.1 | 70.4 | 68 |

Hi = High; Sc = Scattered; Th = Thin; Br = Broken

Figures are from Form 1130-Aer., U. S. Dept. of Agriculture, Weather Bureau, for July 20, 1934.

95F d.b. and 75F w.b. have been the standard design conditions for Detroit for several years. Recently some authorities have become less conservative and recommended the use of 93F d.b. and 73F w.b. However, 95F d.b. and 75F w.b. have been consistently used by the authors and will be used here for illustrative purposes.

When the cooling load of a large building is computed and analyzed the mere values of 95F d.b. and 75F w.b. cannot be used without qualification. That condition is true for only a part of the day and should be so used. Each of the various parts which go to make up the cooling load may vary considerably throughout the day and may have a maximum value at only one time during the day. The times at which these partial loads reach their maximum values will not coincide. Their instantaneous values, however, for any given time can be computed and their sum totalled to give an instantaneous value for the cooling load at that particular time.

### What Temperature Should be Used?

If the design conditions of 95F d.b. and 75F w.b. should not be used for all times during the day, what should be used? The answer to this question is shown in Fig. 1.

The two curves for outdoor dry and wet bulb temperatures shown in Fig. 1 were arrived at by making an "average design day" from a large group of daily records which had as their maximum dry and wet bulb temperature values very near to 95F and 75F, respectively. Since the temperatures used were officially observed and recorded, their variation throughout the day may be said to be typical of Detroit weather.

The two curves representing indoor dry and wet bulb temperatures are values recommended by various authorities and found by the authors to be satisfactory. The two curves in the lower part of Fig. 1 represent the difference between indoor and outdoor dry bulb temperatures and total heat content of the air. As may be seen, the difference between indoor and outdoor temperatures is constantly changing, even on a maximum design day, thereby increasing and decreasing the conductance load throughout the day. The difference in total heat content of the air, however, levels off and remains nearly constant during the afternoon.

The wet and dry bulb temperature curves shown in Fig. 2 were plotted from values shown in Table 1. Fig. 2 shows how nearly an actual daily record may approach the "design day" curves of Fig. 1 when the normal variations of temperature are not disturbed by local storm conditions.

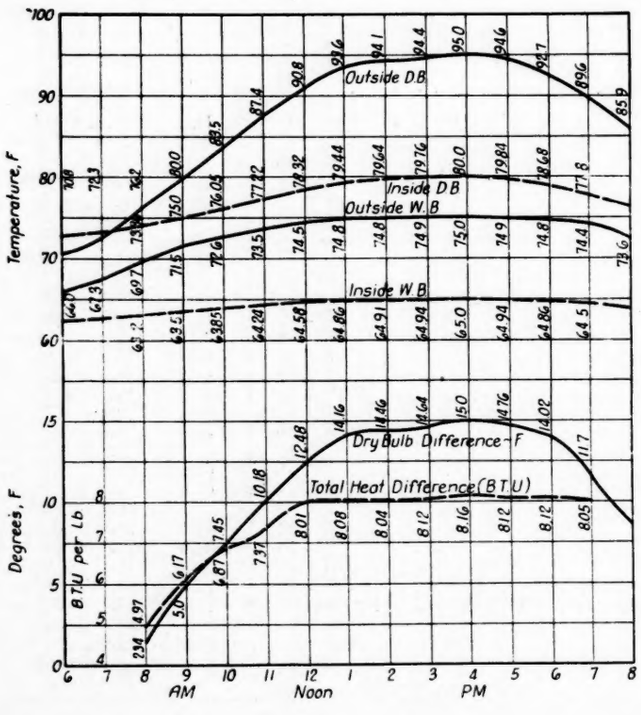
### Detroit Cooling Season

The normal cooling season in Detroit begins sometime in May and usually ends about the middle of September. Since maximum design conditions exist for only a few hours during the warmest days of the season it is evident that they will occur but seldom during a season. "Hot spells" are usually of only a few days duration and are followed by periods of a few days during which much less cooling is required.

In order to establish typical months of which a season might consist, the Weather Bureau records were searched with the idea in mind of finding a May, a June, a July, an August, and a September which would in all respects come the nearest to being normal for that particular month and yet be an actual record from which hourly readings of dry and wet bulb temperatures could be taken.

The months selected were found to be nearer normal or "mean" months than any others for which the hourly readings of dry and wet bulb temperatures were available. The mean dry bulb temperature was not the only factor in the Weather Bureau record which was considered in the selection. Average relative humidity, which was observed three times daily, total precipitation for the month, percentage of sunshine during the month as compared to the maximum possible from sunrise to sunset, and the direction and velocity of the prevailing wind were all considered in addition to the dry bulb temperatures.

In using these data, the dry and wet bulb readings for ten hours of each day from 7 a.m. to 5 p.m. were tabulated. The wet bulb readings were arranged in steps of 4F each, as is shown in Table 2. For each step the dry bulb temperatures were averaged and tabulated so that the month would consist of definite



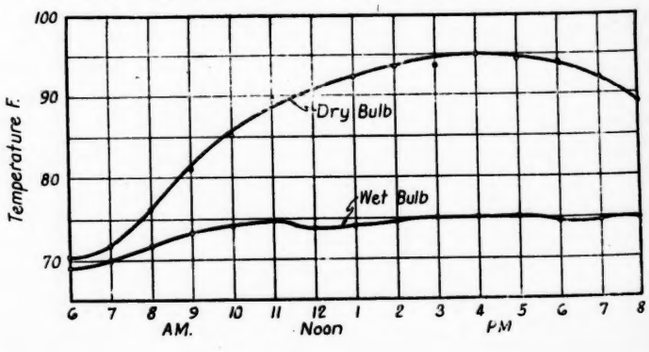




*Fig. 1 (Left). Design day for load computations. Fig. 2 (Below). Dry and wet bulb readings for July 20, 1934.*

TABLE 2—WET AND DRY BULB TEMPERATURES, AND HOURS WET BULB TEMPERATURE INDICATES THAT COOLING IS REQUIRED IN DETROIT IN A NORMAL SEASON.

(For Daytime Loads Only)

| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Wet Bulb Range | | May | | June | | July | | August | | September | |
| Limits of 4F Range—(F) | Mean W.B. Temperature In 4F Range—(F) | Hours W.B. Is In 4F Range | Mean D.B. Reading During W.B. Range—F | Hours W.B. Is In 4F Range | Mean D.B. Reading During W.B. Range—F | Hours W.B. Is In 4F Range | Mean D.B. Reading During W.B. Range—F | Hours W.B. Is In 4F Range | Mean D.B. Reading During W.B. Range—F | Hours W.B. Is In 4F Range | Mean D.B. Reading During W.B. Range—F |
| 44.5—48.5 | 47 | 40 | 60 | 10 | 61 | — | — | 1 | 54 | 4 | 59 |
| 48.5—52.5 | 51 | 31 | 66 | 22 | 63 | 2 | 56 | 3 | 58 | 11 | 59 |
| 52.5—56.5 | 55 | 37 | 68.5 | 32 | 67 | 27 | 63 | 19 | 63 | 22 | 65 |
| 56.5—60.5 | 59 | 30 | 68 | 43 | 67 | 73 | 69 | 58 | 68 | 36 | 65.5 |
| 60.5—64.5 | 63 | 32 | 76 | 56 | 71 | 64 | 73 | 116 | 74 | 52 | 71 |
| 64.5—68.5 | 67 | 21 | 80 | 82 | 77 | 77 | 77 | 65 | 80 | 65 | 75.5 |
| 68.5—72.5 | 71 | — | — | 50 | 79 | 46 | 82 | 28 | 79 | 34 | 83 |
| 72.5—76.5 | 75 | — | — | 1 | 81 | 20 | 88 | 15 | 89 | 13 | 86 |
| Total Hours | | 191 | | 296 | | 309 | | 305 | | 237 | |

Summary of Operating Hours

| Month | Cooling | |
|---|---|---|
| | Hours Required | Hours Not Required |
| May | 191 | 119 |
| June | 296 | 4 |
| July | 309 | 1 |
| August | 305 | 5 |
| September | 237 | 63 |
| Total | 1338 | 192 |

Table is for period from May 1st to September 30th, inclusive; 10 hours per day (7:00 a.m. to 5:00 p.m.); 7 days per week. Data based on a study of hourly wet and dry bulb temperatures from Weather Bureau records, from which an actual record of a "normal" or "mean" month was selected. Totals from these records were counted and tabulated.

groups of wet bulb temperatures with their respective dry bulb readings. It can be observed by Table 2 that the average dry bulb temperatures vary from one month to another, showing which months had the higher humidities and which the lower.

Columns 3, 5, 7, 9, and 11 in Table 2 show the number of hours during the month that the different steps of wet bulb temperatures existed. Where the number of hours shown are less than 10 per day for the month the remaining hours had wet bulb temperatures below 47F and were not considered.

### Data Applied to a Problem

In applying this table to the analysis of a particular problem, an installation familiar to the authors will be used. The various components of the load are as follows:

| | |
|---|---|
| Lighting | 24.4% |
| Glass (sun effect and conductance) | 22.7% |
| Ventilation | 25.5% |
| Occupants | 13.1% |
| Fan and pump motor hp. | 5.7% |
| Roof | 3.4% |
| Wall conductance and miscellaneous | 5.2% |
| Total | 100.% |
| Sensible to total heat ratio | 80% |

The percentage figures are based on the partial loads at maximum design conditions.

The average load during the 10-hr. period (7 a.m. to 5 p.m.) on a maximum design day is about 79% of the maximum design load. Likewise, deducting the average ventilating load from the average total load, the remainder is found to be 72% of the maximum design load. This 72%, or 72 tons on the basis of a 100-ton load, is used as the base load shown in column 4 of Table 3.

In the fifth column of Table 3 the load due to ventilation is shown. Positive values indicate that the outdoor air contains more heat than does the air at indoor conditions and, conversely, negative values indicate that the outdoor air will have some cooling effect and will reduce the load by the amount shown.

In this particular problem the load due to conductance varies approximately 0.5 tons per degree variation in the dry bulb temperature. Since the conductance load was computed for a dry bulb temperature of 95F outside, all values in column 6 of Table 3 are negative as no dry bulb temperature of over 95F is shown. Column 9 shows the number of total ton-hours per step of wet bulb temperatures.

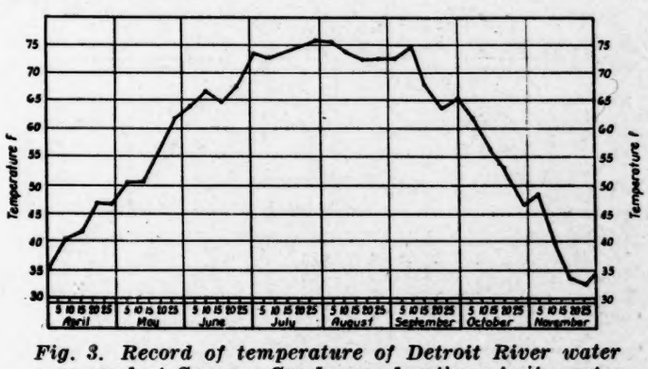



*Fig. 3. Record of temperature of Detroit River water measured at Connors Creek near location of city water supply intake.*

From the summary at the bottom of Table 2 it may be said that a normal season for Detroit would consist of about 1300 hours of operation for an office type building, and from the summary at the bottom of Table 3 the average operating load would be approximately 61% of the maximum design load, computed for outside conditions of 95F d.b. and 75F w.b.

It can be seen from these tables that the weather will be such that it may be economical so to design the air conditioning system that full advantage can be taken of opportunities to lower the cooling load by using outdoor air and evaporative cooling. An economic study can be made to ascertain whether or not it will be profitable to provide these facilities for any particular problem.

### Detroit Water Data

The heat absorbed from an air conditioned space is, in a majority of cases, given up to water. The water may be used directly as in a spray chamber, it may be circulated through cooling coils, or used in cooling refrigerating machines. Whatever its use, the temperature of the water supply as well as its abundance is a very important factor for the design engineer to consider.

The Detroit River is the source of the public water

**TABLE 3—APPLICATION OF TABLE 2 TO A 100-TON DAYTIME LOAD IN DETROIT**

| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
|---|---|---|---|---|---|---|---|---|---|
| Month | Outside Temperatures | | Load Components (In Tons, or Per Cent) | | | | Hours From Table 2 | Ton-Hours | |
| | Mean W.B. | Mean D.B. | Base | Ventilating | Conductance | Total | | In Period | Monthly Total |
| MAY | 67 | 80 | 72.0 | + 9.0 | — 7.85 | 73.15 | 21 | 1536 | |
| | 63 | 76 | 72.0 | 0 | — 10.4 | 61.6 | 32 | 1970 | |
| | 59 | 68 | 72.0 | — 7.9 | — 14.6 | 49.6 | 30 | 1488 | |
| | 55 | 68.5 | 72.0 | — 14.1 | — 14.8 | 43.1 | 37 | 1592 | |
| | 51 | 66 | 72.0 | — 24.0 | — 15.6 | 32.4 | 31 | 1000 | |
| | 47 | 60 | 72.0 | — 31.3 | — 18.3 | 22.4 | 40 | 895 | 8481 |
| JUNE | 75 | 81 | 72.0 | + 28.0 | — 7.33 | 92.67 | 1 | 93 | |
| | 71 | 79 | 72.0 | + 15.85 | — 8.38 | 79.47 | 50 | 3974 | |
| | 67 | 77 | 72.0 | + 9.0 | — 9.33 | 71.67 | 82 | 5874 | |
| | 63 | 71 | 72.0 | 0 | — 12.6 | 59.4 | 56 | 3325 | |
| | 59 | 67 | 72.0 | — 7.9 | — 14.63 | 49.47 | 43 | 2122 | |
| | 55 | 67 | 72.0 | — 14.1 | — 14.63 | 43.27 | 32 | 1383 | |
| | 51 | 63 | 72.0 | — 24.0 | — 16.75 | 31.25 | 22 | 688 | |
| | 47 | 61 | 72.0 | — 31.3 | — 17.8 | 22.9 | 10 | 229 | 17688 |
| JULY | 75 | 88 | 72.0 | + 28.0 | — 3.68 | 96.32 | 20 | 1926 | |
| | 71 | 82 | 72.0 | + 15.85 | — 6.8 | 81.05 | 46 | 3730 | |
| | 67 | 77 | 72.0 | + 9.0 | — 9.4 | 71.6 | 77 | 7510 | |
| | 63 | 73 | 72.0 | 0 | — 11.5 | 60.5 | 64 | 3870 | |
| | 59 | 69 | 72.0 | — 7.9 | — 13.58 | 50.52 | 73 | 3690 | |
| | 55 | 63 | 72.0 | — 14.1 | — 16.75 | 41.15 | 27 | 1108 | |
| | 51 | 56 | 72.0 | — 24.0 | — 20.4 | 27.6 | 2 | 55 | 21889 |
| AUG. | 75 | 89 | 72.0 | + 28.0 | — 3.15 | 96.85 | 15 | 1453 | |
| | 71 | 79 | 72.0 | + 15.85 | — 8.38 | 79.45 | 28 | 2225 | |
| | 67 | 80 | 72.0 | + 9.0 | — 7.86 | 73.14 | 65 | 4760 | |
| | 63 | 74 | 72.0 | 0 | — 10.98 | 61.02 | 116 | 7100 | |
| | 59 | 68 | 72.0 | — 7.9 | — 14.52 | 49.58 | 58 | 2875 | |
| | 55 | 63 | 72.0 | — 14.1 | — 16.72 | 41.18 | 19 | 782 | |
| | 51 | 58 | 72.0 | — 24.0 | — 19.35 | 28.65 | 3 | 86 | |
| | 47 | 54 | 72.0 | — 31.3 | — 21.4 | 19.3 | 1 | 19 | 19300 |
| SEPT. | 75 | 86 | 72.0 | + 28.0 | — 4.74 | 95.26 | 13 | 1240 | |
| | 71 | 83 | 72.0 | + 15.85 | — 7.28 | 80.57 | 34 | 2740 | |
| | 67 | 75.5 | 72.0 | + 9.0 | — 10.18 | 70.82 | 65 | 4610 | |
| | 63 | 71 | 72.0 | 0 | — 12.55 | 59.45 | 52 | 3090 | |
| | 59 | 65.5 | 72.0 | — 7.9 | — 15.4 | 48.7 | 36 | 1750 | |
| | 55 | 65 | 72.0 | — 14.1 | — 15.7 | 42.2 | 22 | 928 | |
| | 51 | 59 | 72.0 | — 24.0 | — 18.83 | 29.17 | 11 | 321 | |
| | 47 | 59 | 72.0 | — 31.3 | — 18.83 | 21.87 | 4 | 87 | 14766 |

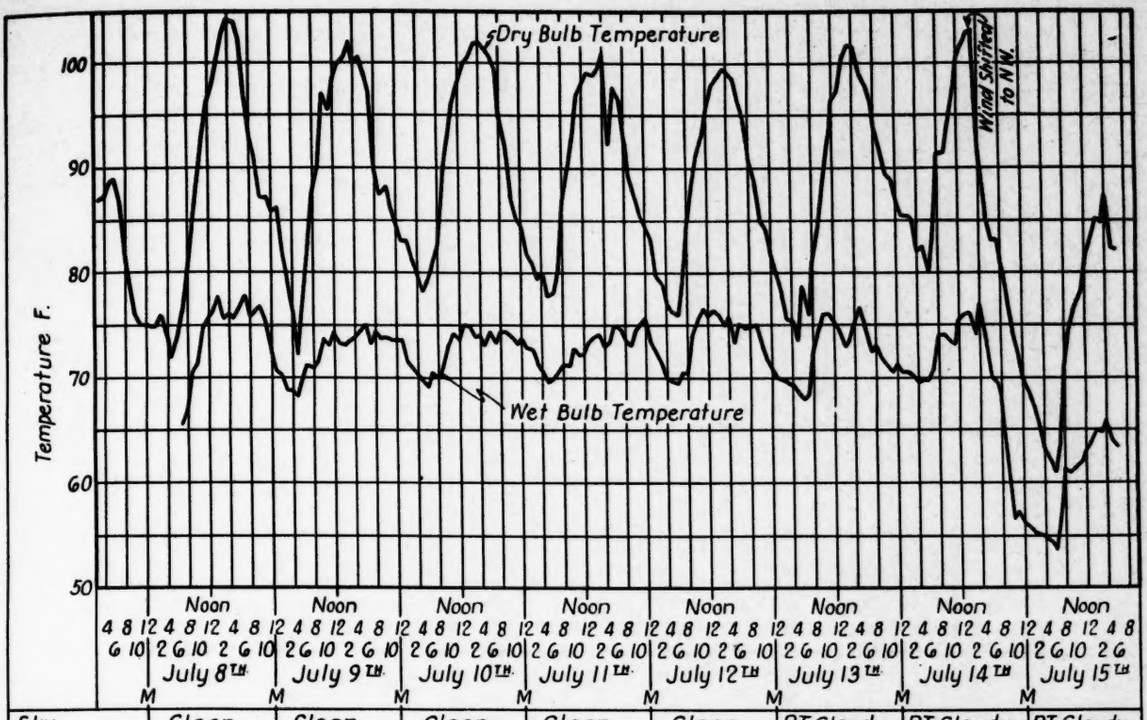
Summary of Ton-Hours

| Month | Ton-Hours | |
|---|---|---|
| | Monthly | % of Seasonal |
| May | 8481 | 10.5 |
| June | 17688 | 21.8 |
| July | 21889 | 26.8 |
| August | 19300 | 22.7 |
| September | 14766 | 18.2 |
| Total | 82124 | 100.0 |

Total cooling hours, May 1—Sept. 30 = 1338 (from Table 2).
Total capacity ton-hours = 1338 × 100 = 133,800.
Average seasonal load = 82,124 ÷ 133,800 = 61.4 tons per 100 tons of max. load.

Table is for May 1st to Sept. 30th, inclusive; 10 hours per day (7:00 A.M. to 5:00 P.M.); 7 days per week.

Columns 1, 2 and 8 from Table 2. Column 9 = Column 7 × Column 8.




| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Sky | Clear | Clear | Clear | Clear | Clear | PT Cloudy | PT Cloudy | PT Cloudy |
| Sunshine | 100% | 100% | 93% | 93% | 100% | 98% | 65% | 72% |
| Wind Velocity | 11 | 13 | 15 | 10 | 14 | 13 | 17 | 14 |
| Wind Direction | S. | W. | W. | N. | N.E | S. | N W. | N E. |

*Fig. 4. Dry and wet bulb temperatures during record heat wave, July, 1936; greatest increase of d.b. in 1 hr., 8 1/2F on 14th; greatest decrease was 12 1/2F also on 14th.*

supply system for the city proper, but some of the suburban districts depend upon deep wells. The river front for many miles is dotted with power plants and factories which use its water in enormous quantities for cooling purposes. The temperature of the river water has been taken and recorded for many years at the four main power plants of the Detroit Edison Company. It varies seasonally throughout the year, but the variation is so regular that it can be predicted to within a few degrees for any given time. Fig. 3 shows a typical summer's variation at the Connors Creek plant, near where the intake to the city water supply is located. Tap water temperatures follow the curve of Fig. 3 closely and can be considered as being identical for design purposes.

A careful study of these changing temperatures will, in many installations, disclose economies to be made by varying the operating methods to suit the water temperature.

Deep wells have recently been used as a source of cooling medium in a number of installations. Their dependability is not beyond question, however, for in some cases water has not been found at all, in some the quantity is limited, and in at least one case the temperature was found to be too high to obtain proper dehumidification. Several installations have been successful and are operating regularly with water temperatures of about 52F.

**TABLE 4—NORMAL PER CENT OF SUNSHINE HOURS IN DETROIT**

| Month | Per Cent |
|---|---|
| May | 58 |
| June | 64 |
| July | 68 |
| August | 66 |
| September | 61 |

### Hours of Sunshine

Another factor which influences the seasonal load of an air conditioning plant is the amount of time during which the sun shines. This is not considered in the design of the plant for the capacity must be great enough to allow for a maximum amount of heat from the sunlight. It should be considered, however, when the problem of selecting awnings or other protection from the sun has to be solved.

Detroit does not have what would be called a "sunny climate." Very few days during an entire year are 100% sunshine days, although it is by no means the most cloudy of all localities. The records of the Weather Bureau are again brought to the fore in giving the

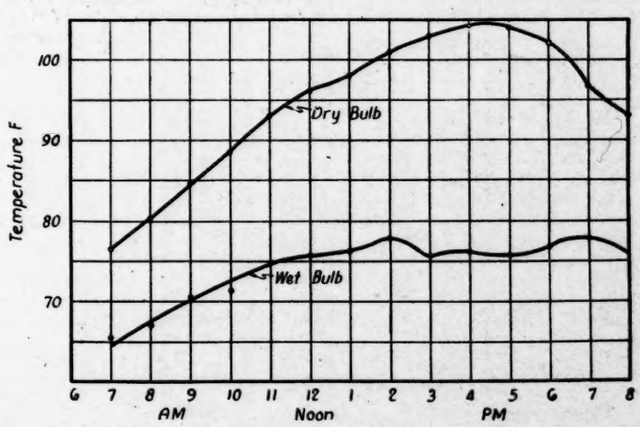



*Fig. 5. Dry and wet bulb readings for July 8, 1936.*

TABLE 5—AVERAGE AND EXTREME SUMMER WINDS IN DETROIT

| Month | Hourly Wind Velocity (M.P.H.) | |
|---|---|---|
| | Average | Greatest Average |
| May | 10.7 | 14.0 in 1909 |
| June | 10.6 | 12.9 in 1908 |
| July | 10.0 | 12.1 in 1911 |
| August | 9.4 | 11.5 in 1910 |
| September | 10.7 | 12.1 in 1909 |

Prevailing Direction is SW, all months.

| Month | Maximum Wind Velocity (M.P.H.) and Time of Occurrence |
|---|---|
| May | 57 on 5-23-1893, SW |
| June | 54 on 6-19-1913, NW |
| July | 47 on 7-2-1909, SW |
| August | 47 on 8-15-1909, NW |
| September | 53 on 9-5-1912, NW |

Wind direction is that at time of maximum velocity.

per cent of actual sunshine based on the total number of hours of possible sunshine. The figures for the five months of the cooling season are presented in Table 4.

### Summer Winds

While wind conditions during the cooling season do not affect the refrigerating load as much as they do the heating load during the winter months, they are important factors in determining the partial loads due to infiltration and conductance. The rate of infiltration depends a great deal upon the type of construction, but may be doubled by a high wind from the exposed side. Fortunately, most of the higher winds in Detroit come from the northerly directions, while the prevailing winds are from the south and west.

Table 5 gives the recorded data for Detroit, dating from 1871 to the present time.

### Extreme Summer Weather

After consideration has been made of the *normal* climatic conditions of a locality, it is well to look into the extreme conditions in order to study methods of caring for similar cases when they occur in the future.

The record heat wave of recent years occurred during July, 1936. Fig. 4 shows the hourly dry and wet bulb temperatures for a period of eight days, beginning July 8, 1936. Fig. 5 shows how the maximum dry bulb day compares with a typical design day. This particular time is the only case in which extremely high dry bulb temperatures were observed for more than three consecutive days. During the seven days of high temperatures there was a total of 24 hr. during which the dry bulb was over 100F. There was an average of 8 hr daily for seven days during which the dry bulb was over 95F and the wet bulb above 73F. The average lowest dry bulb temperature during each 24 hr. occurred about 5 a.m. and was 75½F. The average of lowest wet bulbs was 69F while the wet bulb temperature did not go below 68F at any time during the seven days. The end of the heat wave was caused by a shifting of the wind from the south to the northwest.

### Operating in Extreme Weather

When conditions as extreme as these exist the question of how to operate immediately arises. Part of the answer lies in raising the conditions inside the cooled building to conform to the higher dry bulb temperatures outside. How large a part is taken care of in this manner depends upon how much margin of capacity the system actually has above design rating.

If straight line variations between indoor and outdoor dry and wet bulb temperatures, respectively, are used an indoor wet bulb of 65.62F should be maintained when the outdoor wet bulb is 80F. Also the indoor dry bulb temperature may be maintained at 83F when the outdoor dry bulb is 104F.

Table 6 shows the effect in per cent which each of three different days had upon the total load. Number 1 condition represents the maximum dry bulb temperature which occurred during the previously mentioned heat wave. The net effect of the increased ventilating and conductance loads after adjusting the inside conditions upward was an increase of 7.3% over the design load on a 95F d.b. and 75F w.b. basis.

Number 2 condition was that of the maximum wet bulb reading during the same heat wave. By the same method its net effect was found to be 7.4% or practically the same as that of the highest dry bulb condition.

Number 3 condition represents the highest wet bulb reading on record for Detroit. Using the same method, its net effect is found to be 9.8% or very nearly 10%. This is such a large increase over the design rating that it is doubtful if any air conditioning system would be capable of maintaining the desired indoor temperatures.

For the other side of the picture, that of extremely cool weather, little if anything need be said. From Table 2 it can be seen that very few hours during the day in the months of June, July, and August are cool enough to allow all cooling inside a building to be done with outdoor air. At other times, however, both in spring and fall, there are many days during which a proper mixture of indoor and outdoor air may be used in maintaining proper indoor conditions.

TABLE 6—EFFECTS OF EXTREME WEATHER CONDITIONS ON THE DESIGN LOAD IN DETROIT

| Extreme Condition Considered | | Outdoor Temperature, F | | Building Load, Tons | | | |
|---|---|---|---|---|---|---|---|
| No. | | D.B. | W.B. | Base | Ventilation | Conduction | Total |
| 1 | Day of Max. Dry Bulb (1936) | 104.2 | 76 | 72 | + 30.5 | + 4.8 | 107.3 |
| 2 | Day of Max. Wet Bulb (1936) | 97.0 | 78 | 72 | + 36.4 | + 1.0 | 107.4 |
| 3 | Day of Record Wet Bulb | 86.0 | 80 | 72 | + 42.5 | — 4.7 | 109.8 |

# ESTIMATING THE HEAT GIVEN OFF BY PIPES, PIPE COILS, AND TANKS

## TABLE 1—HEAT EMISSIONS OF BARE PIPES, TUBES, PIPE COILS, AND TANKS
(70F Air and 215F Surface Temperature)

### Vertical Wall Coils, Pipes Horizontal

| Pipe Diameter, Inches | Number of Pipes, High | | | | | | |
|---|---|---|---|---|---|---|---|
| | 1 | 2 | 4 | 6 | 8 | 10 | 12 |
| | Heat Emission (H) per Lineal Ft. of Coil, E.D.R. | | | | | | |
| 1 | 0.5 | 1.0 | 1.9 | 2.7 | 3.5 | 4.2 | 4.7 |
| 1¼ | 0.6 | 1.1 | 2.1 | 3.0 | 3.8 | 4.5 | 5.4 |
| 1½ | 0.7 | 1.2 | 2.3 | 3.3 | 4.1 | 4.8 | 5.8 |

### Ceiling Coils, Mounted Horizontally

| Pipe Diameter, Inches | Number of Pipes, Wide | | | | | | |
|---|---|---|---|---|---|---|---|
| | 1 | 2 | 4 | 6 | 8 | 10 | 12 |
| | Heat Emission (H) per Lineal Ft. of Coil, E.D.R. | | | | | | |
| 1 | 0.5 | 1.1 | 2.2 | 3.2 | 4.3 | 5.4 | 6.5 |
| 1¼ | 0.6 | 1.2 | 2.4 | 3.6 | 4.8 | 6.0 | 7.2 |
| 1½ | 0.7 | 1.4 | 2.8 | 4.2 | 5.5 | 6.9 | 8.3 |

### Horizontal or Vertical Pipe or Tube

| Pipe or Tube Diameter, Inches | Heat Emission (H) per Lineal Ft., E.D.R. | |
|---|---|---|
| | Iron | Copper |
| ½ | 0.36 | 0.22 |
| ¾ | 0.44 | 0.29 |
| 1 | 0.55 | 0.37 |
| 1¼ | 0.68 | 0.46 |
| 1½ | 0.76 | 0.51 |
| 2 | 0.90 | 0.63 |
| 2½ | 1.12 | 0.78 |
| 3 | 1.32 | 0.91 |
| 4 | 1.70 | 1.17 |
| 5 | 2.05 | 1.42 |
| 6 | 2.40 | 1.68 |
| 8 | 3.07 | — |
| 10 | 3.70 | — |

### Cylindrical Iron Tanks, Either Horizontal or Vertical

| Tank Diameter, Inches | Tank Length, Inches | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | 18 | 24 | 30 | 36 | 42 | 48 | 60 | 72 | 84 | 96 | 120 |
| | Total Heat Emission, E.D.R. | | | | | | | | | | |
| 12 | 8.4 | 10.5 | 12.6 | 14.6 | 16.7 | 18.9 | 23.1 | 26.6 | 31.5 | 35.6 | 43.8 |
| 14 | 10.2 | 12.6 | 15.1 | 17.5 | 20.0 | 22.4 | 27.2 | 32.1 | 36.9 | 41.8 | 51.6 |
| 16 | 12.1 | 14.8 | 17.7 | 20.5 | 23.3 | 26.0 | 31.6 | 37.3 | 42.6 | 48.0 | 58.8 |
| 18 | 14.1 | 17.2 | 20.4 | 23.5 | 26.6 | 29.7 | 36.0 | 42.2 | 47.8 | 54.7 | 67.4 |
| 20 | 16.1 | 19.7 | 23.2 | 26.3 | 30.1 | 33.7 | 40.5 | 47.5 | 54.0 | 61.3 | 75.5 |
| 22 | 18.4 | 22.2 | 26.0 | 29.5 | 33.7 | 37.4 | 45.1 | 52.8 | 60.6 | 68.1 | 83.5 |
| 24 | 20.9 | 25.1 | 29.3 | 33.3 | 37.6 | 41.7 | 51.4 | 58.4 | 66.8 | 75.2 | 91.8 |
| 30 | 28.8 | 33.9 | 39.1 | 44.5 | 49.5 | 54.8 | 65.3 | 75.5 | 86.1 | 96.6 | 118.0 |
| 36 | 37.5 | 43.7 | 50.0 | 56.2 | 62.6 | 68.6 | 81.2 | 93.9 | 106.5 | 119.0 | 144.0 |
| 42 | 47.4 | 54.7 | 62.0 | 69.4 | 76.5 | 83.9 | 98.5 | 113.0 | 127.0 | 142.0 | 172.0 |
| 48 | 58.4 | 66.7 | 75.1 | 83.0 | 90.5 | 100.0 | 117.0 | 134.0 | 151.0 | 166.0 | 202.0 |
| 60 | 83.6 | 94.0 | 105.0 | 114.0 | 126.0 | 136.0 | 157.0 | 178.0 | 198.0 | 220.0 | 261.0 |
| 72 | 113.0 | 125.0 | 138.0 | 150.0 | 163.0 | 175.0 | 200.0 | 225.0 | 251.0 | 276.0 | 326.0 |

## TABLE 2—RELATIVE HEAT EMISSIONS OF BARE PIPES, TUBES AND TANKS FOR VARIOUS SURFACE AND ROOM TEMPERATURES

| Room Temperature, F | Surface Temperature, F | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | 150 | 160 | 170 | 180 | 190 | 200 | 210 | 215 | 250 | 275 | 300 |
| | Multipliers (F) For Pipes and Tubes | | | | | | | | | | |
| 40 | 0.72 | 0.80 | 0.88 | 0.96 | 1.05 | 1.13 | 1.21 | 1.26 | 1.58 | 1.80 | 2.04 |
| 50 | 0.64 | 0.72 | 0.80 | 0.88 | 0.96 | 1.05 | 1.13 | 1.17 | 1.48 | 1.72 | 1.94 |
| 60 | 0.56 | 0.64 | 0.72 | 0.80 | 0.88 | 0.96 | 1.05 | 1.09 | 1.39 | 1.63 | 1.85 |
| 65 | 0.52 | 0.60 | 0.68 | 0.76 | 0.84 | 0.92 | 1.00 | 1.05 | 1.35 | 1.53 | 1.80 |
| 70 | 0.48 | 0.56 | 0.54 | 0.72 | 0.80 | 0.88 | 0.96 | 1.00 | 1.30 | 1.53 | 1.76 |
| 75 | 0.45 | 0.52 | 0.60 | 0.68 | 0.76 | 0.84 | 0.92 | 0.96 | 1.26 | 1.48 | 1.72 |
| 80 | 0.42 | 0.48 | 0.56 | 0.64 | 0.72 | 0.80 | 0.88 | 0.92 | 1.21 | 1.44 | 1.68 |
| 90 | 0.34 | 0.42 | 0.48 | 0.56 | 0.64 | 0.72 | 0.80 | 0.84 | 1.13 | 1.35 | 1.58 |
| | 22.4 | 20.3 | 17.7 | 14.6 | 10.9 | 6.4 | 1.2 | 1 | 15 | 31 | 52 |
| | Steam Gage, Vacuum, In. of Mercury | | | | | | | Steam Gage, Pressure, Lb. | | | |

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# ESTIMATING THE HEAT GIVEN OFF BY PIPES, PIPE COILS, AND TANKS

**TABLE 3—RELATIVE EFFECT OF FINISHES ON HEAT EMISSION**

| Finish | Multiplier (P) |
|---|---|
| Bare iron | 1.00 |
| Gold bronze | 0.90 |
| Aluminum bronze | 0.91 |
| White paint | 1.02 |
| Cream paint | 1.04 |
| Red lacquer | 1.00 |
| Dull green paint | .96 |
| Brown paint | 1.05 |

**TABLE 4—RELATIVE EFFECT OF INSULATION ON HEAT EMISSION OF PIPES AND TANKS[1]**

| Pipe Diameter, Inches | Thickness of Insulation, In. | | |
|---|---|---|---|
| | 1 | 1½ | 2 |
| | Multiplying Factor (I) | | |
| ¾ | 0.31 | 0.25 | 0.22 |
| 1 | 0.28 | 0.22 | 0.19 |
| 1½ | 0.27 | 0.20 | 0.17 |
| 2 | 0.24 | 0.19 | 0.16 |
| 2½ | 0.22 | 0.18 | 0.15 |
| 3 | 0.21 | 0.17 | 0.14 |
| 4 | 0.20 | 0.16 | 0.13 |
| 5 | 0.19 | 0.15 | 0.13 |
| 6 | 0.18 | 0.15 | 0.12 |
| 8 | 0.17 | 0.14 | 0.12 |
| 10 | 0.16 | 0.14 | 0.12 |
| Tanks | 0.15 | 0.13 | 0.11 |

[1]These values are approximate for good insulations. For poor insulations, double above figures.

This sheet makes readily available the information necessary in the field to determine the net heat given off by pipes, tubes, pipe coils, and tanks. The data given are not intended to be used in design but are for surveys of existing plants.

Each of the tables can be used alone if desired. To determine the combined effect of the different variables affecting the heat given off refer to the formulas given later.

*Table 1*—Heat emissions in equivalent square feet (E.D.R.)† of bare pipes, tubes, pipe coils, and tanks, standing in still air at 70F and with a 215F heating medium temperature. This table applies to horizontal or vertical pipes, vertical wall pipe coils, ceiling pipe coils, and cylindrical iron tanks either in a vertical or horizontal position.

The figures given in the pipe coil tables show the heat given off in E.D.R. per lineal foot of *coil* while the table on horizontal or vertical pipes or tubes shows the heat given off in E.D.R. per lineal foot of *pipe*. The table on cylindrical iron tanks shows the total heat given off in E.D.R. by the entire tank. All of these assume a 215F heating medium temperature and 70F still air.

*Table 2*—Gives the relative heat emissions of bare pipes, tubes, or tanks under varying heating medium and room temperatures. In general, it may be assumed that the radiator surface temperature will be the same as the temperature of the heating medium. This table shows that, for example, a pipe with 210F steam in an 80F room will give off 0.87 as much heat as one standing in 70F air using 215F steam. Similarly, a pipe coil supplied with hot water and having an average surface temperature of 170F in 70F air has a heat output 0.64 as much as a steam pipe coil in still air at 70F with a 215F surface. The factors given in this table when multiplied by the ratings in Table 1 give the equivalent square feet (E.D.R.) for the room and heating medium temperatures given.

*Table 3*—Painting a surface affects the heat output. This table gives the approximate relative effect of commonly used finishes as compared with a bare iron surface.

*Table 4*—Gives the relative effect of insulation on the heat emission of iron pipes and tanks. This table has been calculated for good grade of insulation. For materials which are poor insulators, double the values shown in the table.

The combined effect of a different room temperature, a different heating medium temperature, and radiator finish can be expressed by the following formula:

$$R = H \times N \times F \times P \ldots\ldots\ldots\ldots (1)$$

where $R$ = Net heat given off in E.D.R. (240 B.t.u. per hr.).
$H$ = Rated E.D.R. as given in Table 1.
$N$ = Number of lineal feet of pipe coil or pipe.
$F$ = Factor from Table 2 depending on the room and heating medium temperature.
$P$ = Multiplier from Table 3, for the finish.

In the case of uninsulated tanks the factor $N$ is dropped out of the above equation.

*Example*—What is the net heat given off by a 10-ft., 2-in. vertical riser in a room maintained at 80F when carrying 1 lb. per sq. in. steam pressure? Pipe is painted with a brown paint.

*Solution*—We can find the net heat given off by substituting in the formula (1)

$$R = H \times N \times F \times P$$

The section on horizontal and vertical pipe shows that $H$ (the rated E.D.R. per lineal foot) for a 2-in. vertical iron pipe, is 0.90.

$N$ (number of lineal feet) is given as 10.

$F$ (correction factor for room and surface temperature) is 0.92 in Table 2.

$P$ (multiplier depending upon the radiator finish) is 1.05 for brown paint from Table 3.

Substituting these figures in the formula

$$R = 0.90 \times 10 \times 0.92 \times 1.05 = 8.7 \text{ E.D.R.}$$

When insulation is applied to a pipe or tank the surface finish does not have an effect on the heat given off and the formula reads as follows:

$$R = H \times N \times F \times I \ldots\ldots\ldots\ldots (2)$$

These terms are the same as expressed above while $I$ equals the multiplier from Table 4, depending upon the insulation.

*Example*—Suppose the pipe in the above example were insulated with 1½ in. of good insulation, what would be the heat given off?

*Solution*—The net heat given off can be found by substituting in formula (2) where

$$R = H \times N \times F \times I$$

$I$ (multiplier depending upon the insulation) is found in Table 4 to be 0.19 for a 2-in. pipe insulated with 1½ in. of good insulation. Substituting in the formula:

$$R = 0.90 \times 10 \times 0.92 \times 0.19$$
$$R = 1.6 \text{ E.D.R.}$$

*Example*—What is the net heat given off by a cylindrical hot water iron tank 60 in. in diameter and 96 in. long when the room temperature is 60F and the hot water temperature is 180F? The tank is insulated with 2 in. of good insulation.

*Solution*—Substituting in formula (2)

$$R = H \times F \times I$$
$$= 220 \times 0.80 \times 0.11$$
$$= 19.4 \text{ E.D.R.}$$

In estimating the net heat given off by a pipe coil or pipe using hot water the formulas given can be used in the same manner as in previous examples. The rating will then be obtained in E.D.R. of 240 B.t.u. per hr. each. However, hot water equipment is rated in hot water E.D.R. It is common practice to call the 240 B.t.u. E.D.R. a steam E.D.R. and to use 150 B.t.u. per hr. as the hot water E.D.R. Therefore, to convert the steam E.D.R. to the hot water E.D.R. it is necessary to multiply by 240/150 or 1.6.

*Example*—What is the net heat given off in hot water E.D.R. by a 20-ft., 10-pipe, vertical wall coil when operating with 180F water in 75F air and finished with a cream paint? The pipe coil is made of 1½-in. pipe.

*Solution*—Substituting in the formula (1)

$$R = H \times N \times F \times P$$
$$= 4.8 \times 20 \times 0.68 \times 1.04$$
$$= 67.8 \text{ E.D.R. (Steam)}$$
$$= 67.8 \times 1.6 = 108.5 \text{ E.D.R. (Water)}$$

†One E.D.R. = 240 B.t.u. per hr.

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# Effects of Ultraviolet Radiation on Air-Borne Bacteria

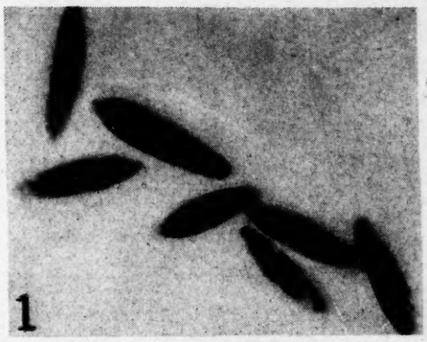
THAT ultraviolet radiation has the power of killing or stopping growth of bacteria was realized almost as long as bacteria have been known to exist, but before the practical use of radiant energy for the killing of bacteria could be effectively made, quantitative values of the various influencing factors were necessary.

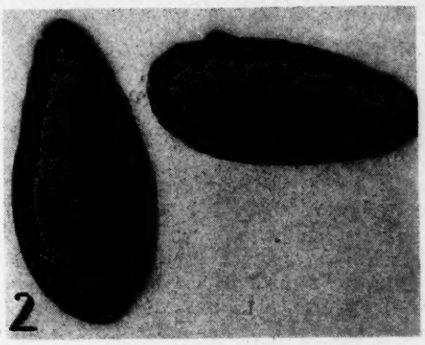
Bacteria are so small that they can be seen only with powerful microscopes. They vary in size from a fraction of a micron (0.00004 in.) to larger sizes. In addition, they multiply rapidly. At the proper temperature and in a suitable medium, each cell divides into two about every twenty to thirty minutes. If bacterial multiplication takes place unchecked at this rate for about twenty-four hours, the descendants of a single cell number about six billion.

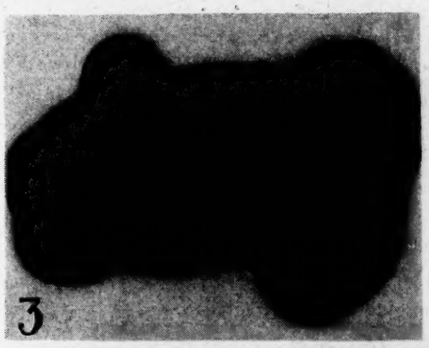
Knowing that certain bands of the ultraviolet spectrum are bactericidal, the first problem of investigators was to develop an inexpensive lamp which would practically emit chiefly those bands and no others. The result of that research is the Sterilamp which Drs. H. C. Rentschler and R. F. James of Westinghouse have developed. The next problem was to determine the relative effects of different radiation sources upon the many types of tiny organisms.

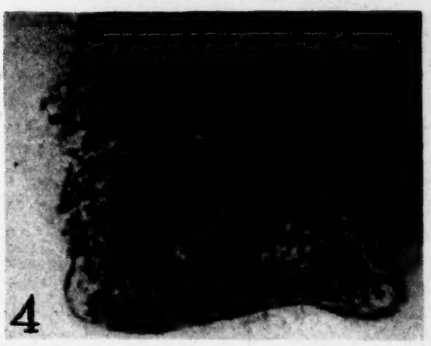
Research showed that the amount of radiation required to kill varied with the different kinds of bacteria, molds and yeast. Thus, while the amount of energy required to destroy a typhoid germ registered seven on the scale they set up, that required for black mold registered 1000. It takes about eight seconds for the 30-in. lamp to kill 95% of the typhoid germs in clear water at a distance of four inches. At the same distance, the lamp requires about nineteen minutes to destroy black mold.

Once the quantitative data were available, it was possible to produce a lamp which requires less than 10 watts of energy, has a continuous life of about 4000 hours, rids even the air of germs, and yet can be operated safely by the layman.




*Death throes of a germ killed by ultraviolet radiation. 1—Normal paramecia. 2—Paramecia showing the distension which occurs after thirty seconds of irradiation by ultraviolet. 3—A paramecium dying from effect of ultraviolet radiation. 4—The paramecium is dead from an internal explosion. Ultraviolet radiation has made this animal burst its skin. Its body is disintegrating and mixing with the surrounding water.*

That the Rentschler-James process is applicable to the atmosphere itself has been demonstrated by several manufacturers who installed these lamps in the air ducts of air conditioning systems. Tests indicated that an exposure of 1.2 seconds killed 90% of the bacteria in the air. Air in a particular location was kept sterile by installing lamps over that spot and flooding it with constant radiation.

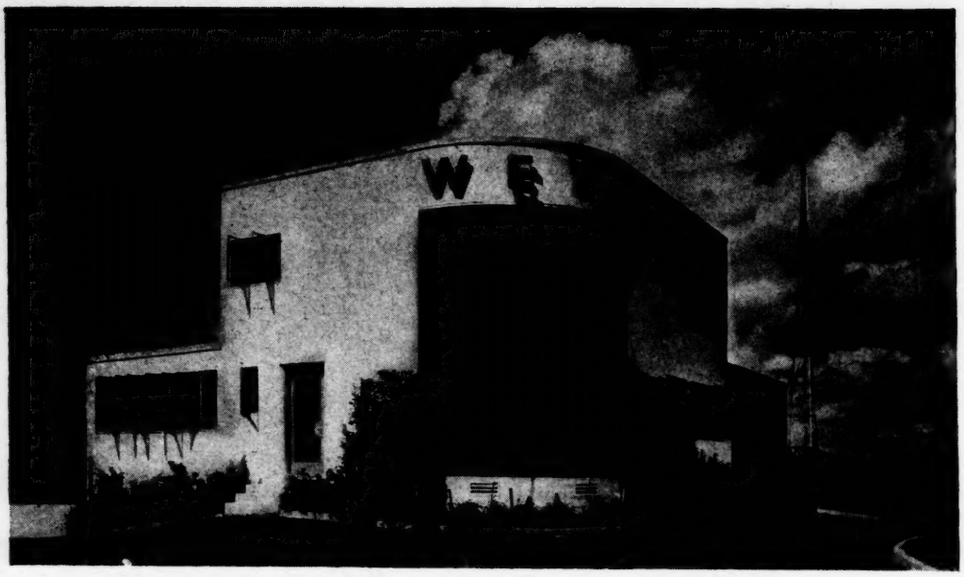
The need for a new sterilizing tool is probably nowhere as pressing as in surgical operating rooms, where air-borne bacteria sometimes cause post-operation infections. The whole aseptic technique used by modern surgeons has provided no defense against contamination from the air.

In preliminary tests petri plates sprayed lightly with a filtered suspension of staphylococcus organisms were rendered sterile after sixty seconds' exposure to the radiation at a distance of five feet. Plates sprayed heavily with an unfiltered suspension of organisms required a longer exposure to the rays. Five minutes' exposure at a distance of five feet killed all but one colony.

Wounds in animals were exposed to the radiation for periods varying from thirty to ninety minutes without apparent damage. Healing, in fact, seemed to be more rapid. Beneath the lamp, operations were then performed on patients, and from the first the results were striking. While the bactericidal radiation did not eliminate more than 80 to 90% of the bacteria in the extreme corners of the room, it did kill virtually all the bacteria in the air about the operative wound, supply and instrument tables.

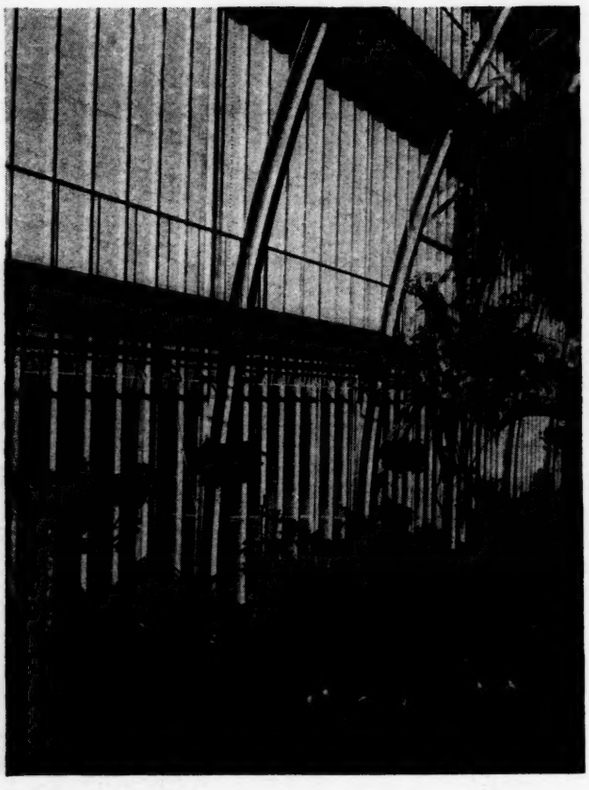
Reports are that operating room infections, which were a constant hazard before these tubes were installed, practically disappeared. The post-operative temperature curves of the patients were much lower than previously. Those major operations performed with the radiation showed no infection.

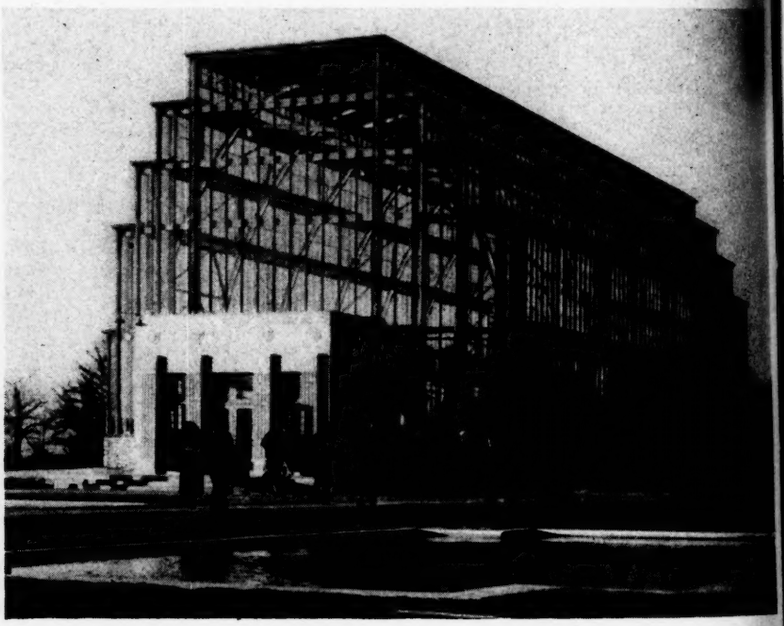
# PICTURE PARAGRAPHS



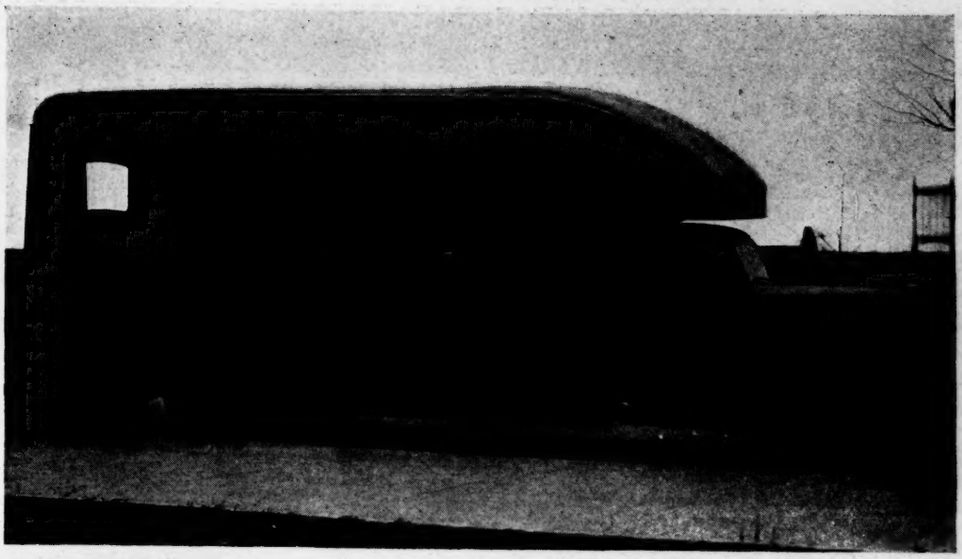
**GRANULATED CORK INSULATION** between the walls cuts down heat losses in the new WEEI broadcasting station, Medford, Mass., leased to CBS. The building, of concrete cinder blocks on a steel frame, is heated by an oil-burning boiler.

**FEMININE WARRIOR** in the field of silicosis is Sara J. Davenport, left, who is the co-author with D. Harrington of the recently issued "Review of Literature on Effects of Breathing Dusts with Special Reference to Silicosis," published by the Bureau of Mines. The publication is an exhaustive abstract of the literature on the subject. Miss Davenport has the title of Principal Translator in the Bureau of Mines, a position which she practically created for herself.



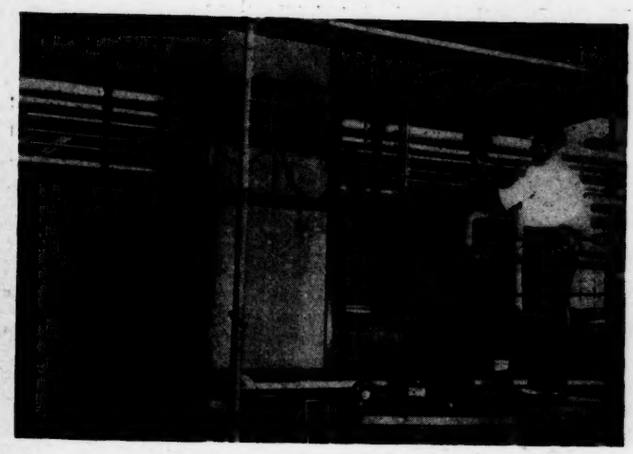


**"JEWEL BOX,"** the new floral conservatory in Forest Park, St. Louis, is shown above, while the interior is illustrated at the left. Of unusual construction, the building is supported by U-bar uprights which carry the glass frames. The U-bars and the heating system piping throughout are of wrought iron, specified by William C. E. Becker, chief engineer of bridges and buildings, City of St. Louis, because the tropical and semi-tropical conditions maintained in the greenhouse are said to cause serious corrosion to ordinary structural metals. Story on page 30. Photographs courtesy A. M. Byers Company.

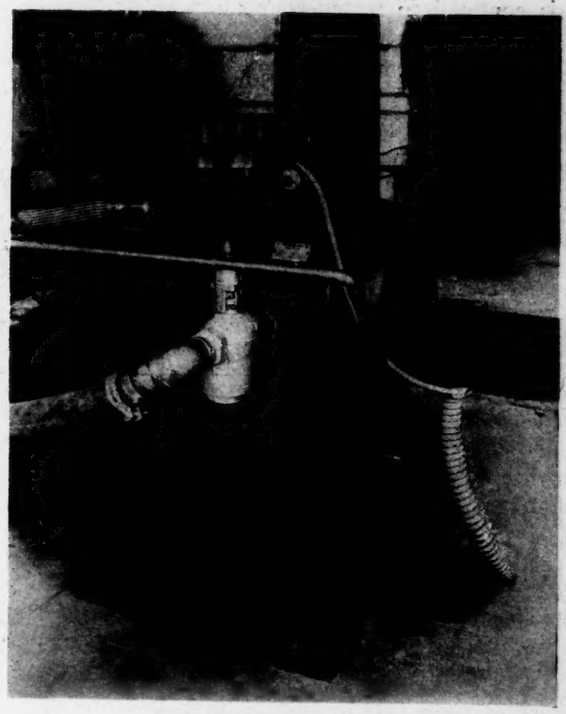


**CRUISING X-RAY LABORATORY** is what the New York State Department of Labor calls its new special travelling truck shown to the right and below. It is sent to industrial centers throughout the state where dust hazards exist and enables complete x-ray examination of plant employes. During the last year over 5000 x-rays were taken of workers exposed to silicosis hazards. The reception room shown below is roomy, well ventilated, and heated or cooled as the weather requires. The photo below is taken from the corridor leading into the x-ray room.

**SEASONAL TREND** of sports gives some unsung genius at Crane Company another opportunity to set up his pipe-fittings athletes. Here the Crane "men of mettle" deftly handle the puck. Last fall they were busily engaged in football.



**AIR DISTRIBUTION,** particularly use of grilles, has been under investigation at Case School of Applied Science for three years. Here is a graduate assistant making velocity and temperature measurements over a portable guide frame divided into 6-in. sections which can be set at various distances in front of the grille.



**TO KEEP VIBRATION OFF THE AIR,** this air conditioning unit in the studios of radio station WNYC, New York, was mounted on six rubber-to-metal mountings which have a minimum frequency of 1090 vibrations per minute.

# Resistance of Miscellaneous Fittings

By JOHN L. ALDEN

*John L. Alden*

**Attended Case and Illinois. B.S. in M.E. and M.E. from Illinois in 1914 and 1927. Handled details of probably the largest grinding and polishing exhaust system ever installed—Remington Arms Company of Delaware—for British Arms Contract, 1915. Later, assistant to mechanical superintendent, Ludlow Manufacturing Associates, and in charge of design, installation, operation, maintenance of about 25 large dust exhaust and low pressure pneumatic conveying systems. Served in Ordnance Department in U. S. and Chemical Warfare Service in A.E.F., discharged as Captain. Five years chief engineer, American Insulating Machinery Co. Since 1926, with Western Electric Co., now superintendent of manufacturing engineering, Kearny, N. J.**

THE excessive losses resulting from the use of short radius elbows in cramped spaces may be reduced by the application of the venturi type elbow suggested by Konrad Meier[1] and investigated by F. L. Busey.[2] Although the venturi elbow saves more than one-half of the pressure loss occurring in elbows whose centerline radius is 0.5 diameters and about one-fifth of the loss in elbows of 1.5 diameters radius, it is by no means universally applicable. For structural reasons, its use is confined to rectangular ducts. Further, it is somewhat more costly than either round or rectangular plain elbows. On the other hand, the extra expense sometimes can be offset by combining the venturi elbow with transformers, short lengths of pipe and similar details so that the pressure and power saving is clear gain.

The flow lines through a short radius plain elbow are indicated schematically in Fig. 50a. The eddies formed downstream of the throat persist in a diminishing degree for several pipe diameters from their source. They are responsible for no small part of the elbow loss. Shaping the pipe wall to conform to the natural flow lines of the accelerated stream discourages the formation of these eddies. An elbow so shaped, together with its downstream expansion piece, constitutes the venturi elbow, Fig. 50b. It will be observed from Fig. 50b that the duct area immediately following the bend is constricted to conform substantially to the vena contracta of the elbow. It is evident that the dimensions of the reduced section is the key to the design of the venturi elbow. To determine these we employ the dimensions of an imaginary resistance known as the "equivalent orifice" or, less descriptively, the "blast area."

[1]"Mechanics of Heating and Ventilating," by Konrad Meier, McGraw-Hill Book Co., New York, 1912, pages 107-108.

[2]"Loss of Pressure Due to Elbows in the Transmission of Air Through Pipes and Ducts," by F. L. Busey, ASHVE Transactions, Vol. 19, 1913, page 366.

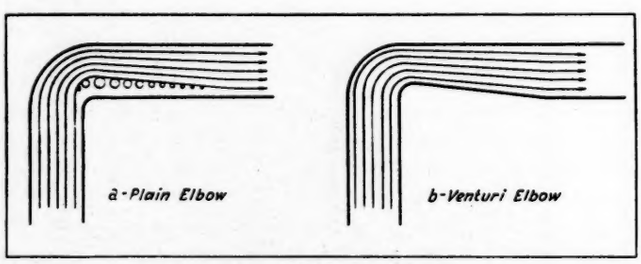


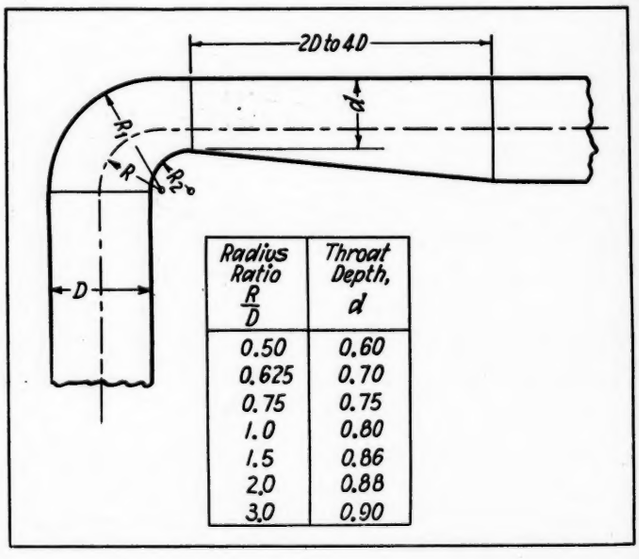

*Fig. 50a and b (above). Approximate flow lines through short radius elbows. Fig. 51 (right). Throat depth of venturi elbows of uniform width.*

### Equivalent Orifice

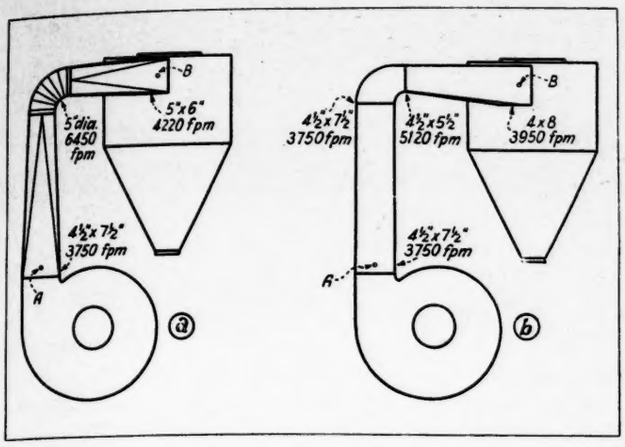
This is the orifice which, if substituted for the elbow, would pass the same air volume under equal impelling pressures. The impelling pressure is the velocity pressure of the approaching stream plus the static pressure required to overcome the elbow loss. The impelling pressure may be expressed as

$$H = (1 + k)h_v$$

where $k$ = elbow loss in velocity heads. It should be noted that $k$ refers to the loss in an elbow only as taken from Table 7 and does not include the regain of pres-




| Radius Ratio $\frac{R}{D}$ | Throat Depth, $d$ |
|---|---|
| 0.50 | 0.60 |
| 0.625 | 0.70 |
| 0.75 | 0.75 |
| 1.0 | 0.80 |
| 1.5 | 0.86 |
| 2.0 | 0.88 |
| 3.0 | 0.90 |



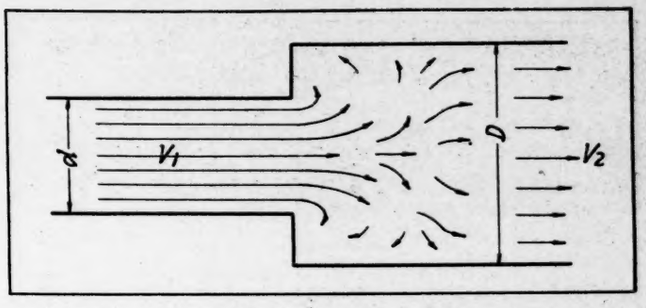




*Fig. 52. (Left) Application of venturi elbow to small fan and cyclone. Fig. 53 (Above). Abrupt enlargement.*

sure which takes place in a downstream pipe.

The equivalent orifice is the theoretically perfect well-rounded orifice ($C_e = 1.00$) whose area is that required to pass the prescribed volume rate if all of the impelling pressure, $H$, were expended as velocity pressure only. Its area in square feet is

$$A = \frac{Q}{4008\sqrt{H}}$$

### Throat Area of Venturi Elbow

The area of the vena contracta formed in the exit plane of an elbow closely approximates that of its equivalent orifice. In consequence, if the area of the constricted throat of the venturi elbow is made equal to or slightly greater than the area of the equivalent orifice of a plain elbow of equal radius ratio, the solid boundaries will conform approximately to the natural flow lines. The throat area may be expressed in terms of the approach pipe area as follows:

$$A = a\frac{v}{V} = a\sqrt{\frac{h_v}{H}} = a\sqrt{\frac{1}{1+k}}$$

where

$A$ = venturi throat area,
$a$ = approach pipe area,
$h_v$ = approach pipe velocity head,
$H$ = impelling pressure,
$v$ = average approach pipe velocity,
$V$ = velocity corresponding to H,
$k$ = elbow loss in approach pipe velocity heads.

If the approach pipe, venturi elbow and expansion pipe are of uniform width, the depth of the elbow in the plane of the bend is reduced to form the throat. Using the notation of Fig. 51,

$$d = D\sqrt{\frac{1}{1+k}}$$

The table accompanying Fig. 51 has been prepared from this expression with the exception that the throat depth has been increased somewhat for those elbows whose centerline radii are less than 1.0$D$.

### Typical Application of Venturi Elbow

Fig. 52a illustrates a small fan and cyclone handling the output of a small hammer mill. The piping consisted of a long square-to-round connected to the fan outlet, a round elbow and a transformer at the cyclone. It will be observed that the air was accelerated markedly between the fan and the elbow and decelerated between the elbow and the cyclone. The pressure loss from A to B was measured as 2.2 in. of water. When the construction shown in Fig. 52b was substituted and the pressure drop again measured, the loss from A to B was found to be 0.45 in. of water at the same rate of air flow as in Fig. 52a. Thus, the static pressure saving was about 80%. The venturi elbow was responsible for slightly less than one-half of the improvement, the remainder being due to lessened pipe friction and the absence of deceleration losses.

### Enlargements

Bernouilli's theorem shows that the drop in velocity pressure resulting from an enlargement in a pipe is regained as static pressure if the velocity reduction can be made so gently as to permit complete conversion of kinetic- to potential energy. The loss in an enlargement is the amount by which complete conversion fails of attainment. It may be expressed as a function of the difference in velocity pressures in the original and the enlarged sections of pipe. Thus,

$$H_L = k(h_{v_1} - h_{v_2})$$

### Losses in Abrupt Enlargements

The more abrupt the enlargement, the greater is the loss. Thus, the entire difference in velocity heads is lost in an enlargement similar to Fig. 53 wherein $k = 1.0$. No regain of static presssure takes place during the transition from the higher to the lower velocity. The ordinary box-type of gravity trap is an example of sudden enlargement in which the terminal velocity is usually so low for the purpose of promoting settlement of solids that the entire initial velocity pressure is lost.

### Losses in Tapers

When the enlargement is gradual, as in the common taper, $k$ is a function of the included angle. In Fig. 54 $k$ is plotted against the included angle of divergence. It will be observed that no regain of static pressure occurs when the included angle exceeds 60°. This angle, therefore, may be taken as the dividing line between abrupt and gradual enlargements.

No loss need be figured for tapers into which branch pipe tees enter. The velocity drop is small since the enlargement of the main is designed to accommodate the combined flows of the main and branch.

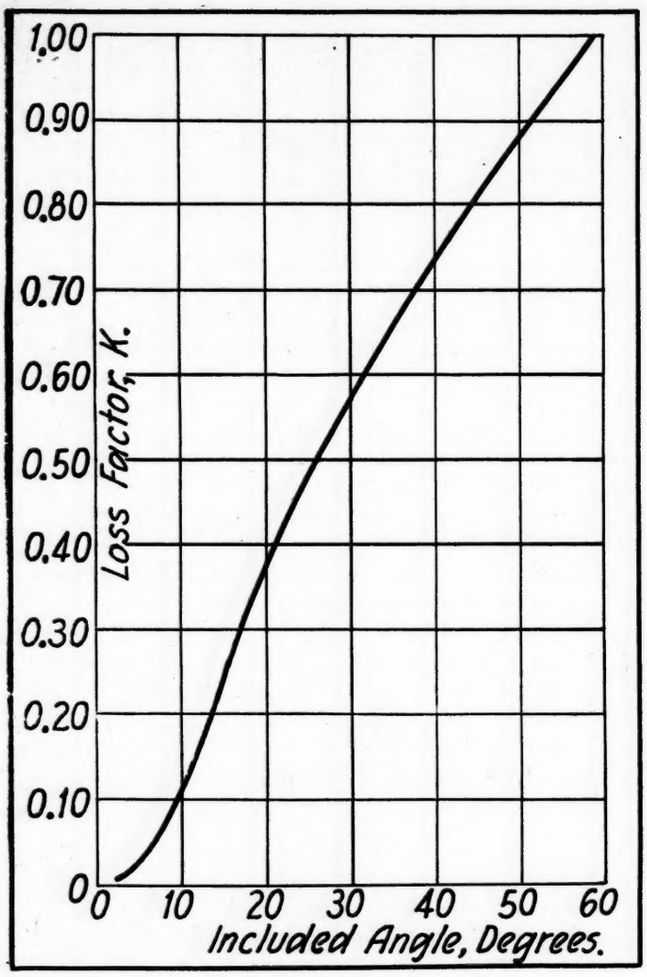



*Fig. 54. Loss in tapered enlargements.*

### Losses in Contractions

The loss by reason of a gradual contraction is small. The value of $k$ is about 0.04 to 0.06 for included angles of convergence of 45° or less. Abrupt contractions introduce vena contracta losses similar to those of the orifices shown in Fig. 37. Abrupt contractions are rare in well designed exhaust systems except as outlets from chambers such as dust arresters, traps and booths in which the velocity of approach is low.

### Losses in Tees

The loss at the junction of a branch with a suction main is the result of the impact of two convergent streams. A pressure drop in the main is produced by the disturbance accompanying the injection of the side stream. Likewise, a pressure drop occurs in the branch stream from its efforts to displace a portion of the main stream at the junction. Fig. 55 represents the flow conditions thought to be present in the region of a common tee. The pressure loss in the main from A to C is believed to be a function of

a. the angle of union, $a$,

b. the relative velocities of the main and branch streams, $V_m$ and $V_b$, and

c. the relative volumetric rates of flow, $Q_m$ and $Q_b$.

It is regrettable that wholly reliable tee loss data cannot be presented. The author knows of no record of systematic investigation of this subject. The few references to tee losses in the literature are contradictory and, for the most part, without rational basis. Although the following data are admittedly incomplete and unsupported by sound experimental evidence, they are believed to be the most reliable yet presented. They are based on scattered field measurements, usually with a pocket manometer and without complete and trustworthy measurements of volumetric flow in main and branch pipes. Nevertheless, their reliability is subject to substantially less suspicion than is true of previously published figures.

TABLE 10—LOSS IN MAIN AT JUNCTION WITH BRANCH
(45° Tee and Equal Main and Branch Velocities)

| Vol. in Upstream Main ÷ Vol. in Branch $\frac{Q_m}{Q_b}$ | Loss in Main, Velocity Heads, Main— $k$ |
|---|---|
| 1 | 0.20 |
| 2 | 0.17 |
| 3 | 0.15 |
| 4 | 0.14 |
| 5 | 0.13 |
| 6 | 0.12 |
| 7 | 0.11 |
| 8 | 0.10 |
| 9 | 0.10 |
| 10 | 0.10 |

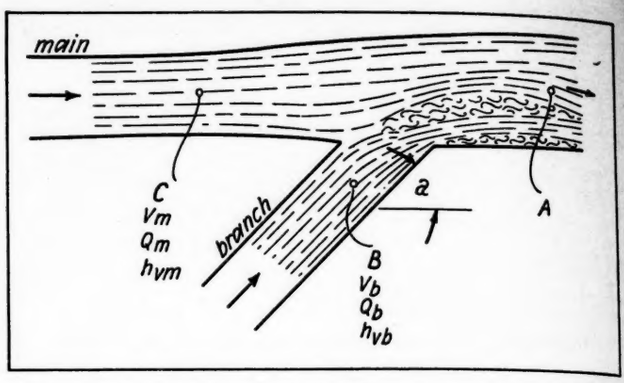



*Fig. 55. Schematic representation of flow conditions at junction of branch pipe and main suction pipe.*

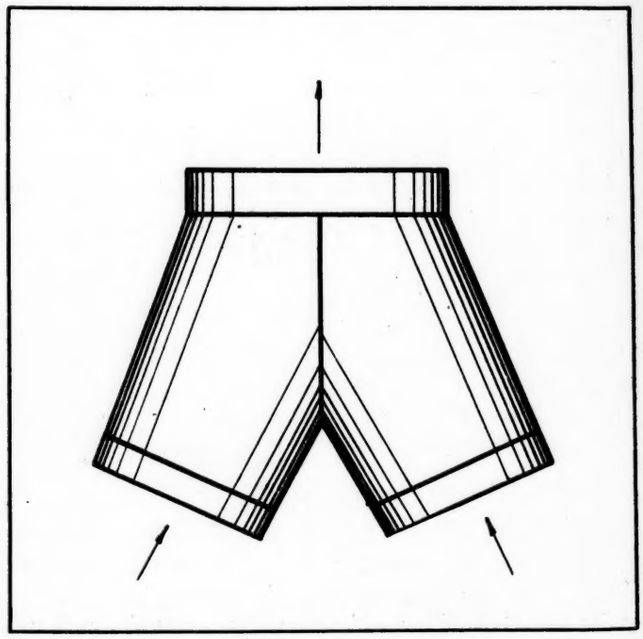


*Fig. 56. Round breeching.*

TABLE 11—Effect of Angle of Junction on Tee Loss

| Angle of Junction, $a$, Degrees | Relative Tee Loss |
|---|---|
| 0 | 0 |
| 15 | 0.1 |
| 30 | 0.5 |
| 45 | 1.0 |
| 60 | 1.7 |
| 75 | 2.5 |
| 90 | 3.4 |

Table 10 gives values for the pressure drop in the main, A to C, Fig. 55, for 45° tees when main and branch velocities are equal. For other angles of junction the loss is thought to be proportional to 1 — cos a as shown in Table 11. Although it is believed that when the velocities in main and branch are markedly unequal, the stream having the lower velocity has higher than normal loss, there is no quantitative evidence to support this belief. Fortunately, there is seldom a great difference in the velocities of the merging streams so that this factor can be ignored.

The normal tee is one in which two streams unite, one the branch stream and the other the stream flowing in the main. A branch entering the dead end of a main is not a true tee in this sense because no current flows in the main pipe upstream of the junction. A tee of this type more nearly resembles a rudimentary form of elbow. Referring to Fig. 55, the loss from main to branch, A to B, may be taken as 0.20 $h_v$ for the normal tee and 0.25 $h_v$ for the tee at the dead end of a main.

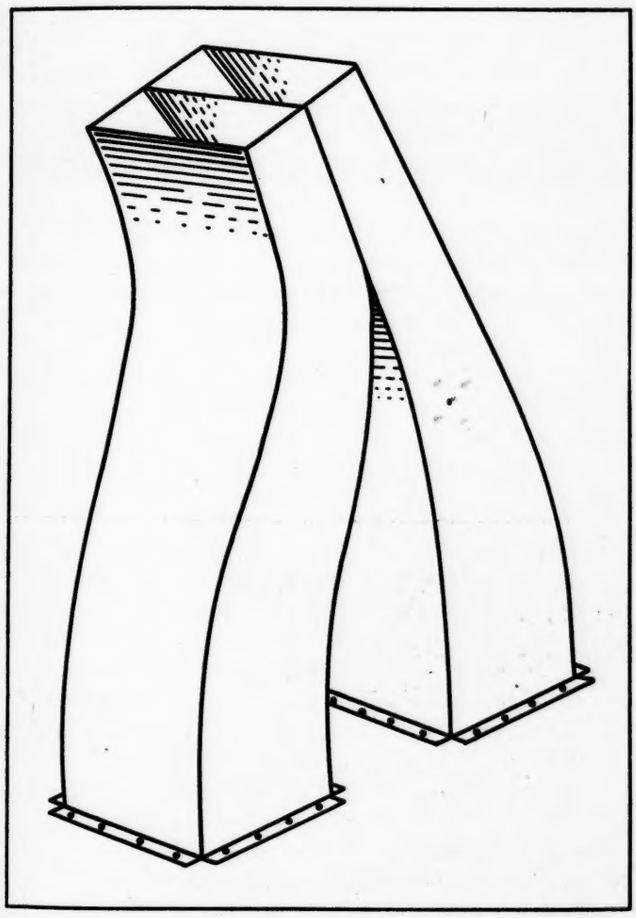


*Fig. 57. Rectangular breeching.*

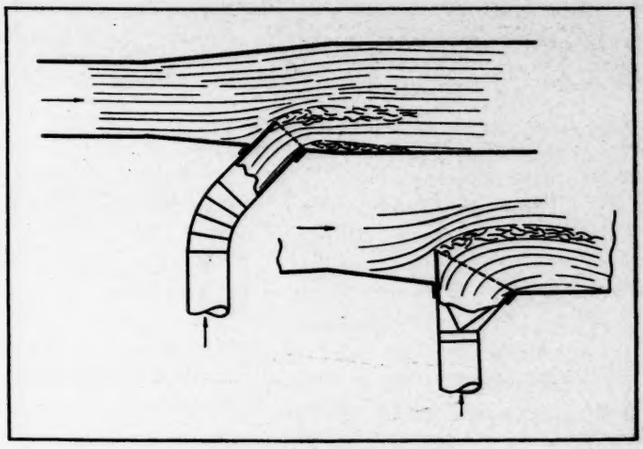


*Fig. 58. Vacuum boosters.*

### Losses in Breechings

The common round breeching or "pair of pants," Fig. 56, is a special form of tee in which both streams bend at the junction. Tables 10 and 11 apply to breechings as well as to tees. The rectangular breeching whose angle of junction is zero, as in Fig. 57, introduces no loss other than that of simple friction in the legs. Hence, it is the preferred construction for the outlets from double fans, for difficult offset breechings and for other situations in which it can compete in cost with the round breeching.

### Vacuum Booster

A special form of tee known as the "vacuum booster" is used occasionally to produce a branch suction greater than that in the main. It consists of an extension of the branch pipe into the main with the open end pointing downstream. The aspirating effect of the main stream raises the branch suction by an amount approaching the main line velocity head. Fig. 58 shows two representative types.

The added energy in the branch stream is obtained at the expense of the flow in the suction main. From scattered field measurements it may be said that the pressure drop in the main due to the presence of the booster is in the neighborhood of 0.3 to 0.5 velocity heads. The vacuum booster is a useful device for correcting a low suction condition at one or two branches of an existing system. It cannot be used at the end of a main but must be installed at a location of substantial main line flow.

### Losses in Transformers

The section of duct forming the transition from a round to a rectangular pipe or vice versa is usually called a "transformer." The loss in such ducts is close to the average of round and rectangular pipes of the same length. It is seldom worth while to compute transformer losses in detail. Ordinarily, the designer takes the round pipe loss from the friction chart, Fig. 44, for the average velocity in the transformer and adds to it a small amount for the transition, often by merely rounding out the loss to the next greater one-tenth inch of water. If substantial velocity change takes place in the transformer, it must be treated as an expansion piece or as a convergent duct.

## KINKS

### Oil Indicator for Boiler Feed Lines

On a number of occasions I have been asked whether or not there is a device on the market that indicates directly the quantity of oil in boiler feed water.

So far as I know, there is not. Without question such an "oil indicator" would be of much value.

In view of the lack of a real "oil indicator," I should say that the most practicable way in which to determine the presence of oil with ordinary standard equipment is to install a good feed water filter in the line. Place a pressure gage ahead of the filter and another gage behind it so that the pressure drop through the filter can be observed at all times. When clean it will be found that the pressure drop is slight. As oil accumulates in the filter cloths the pressure drop increases. A curve can be plotted between time and dirtiness, based on the pressures, which will enable one to know with surprising exactness the amount of oil in the cloths at any time after installation.

If the filter is a good one; that is, if it extracts *all* of the oil, as it should, the exact amount of oil can be determined by weighing the cloths while dirty and then when clean. The difference in weights, of course, is the weight of the oil.—*W. F. S., Newark, N. J.*

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### Curing the Rusty Hot Water Problem

Large hot water storage tanks frequently become corroded inside due to the corrosive effect of the hot water. The rust so formed on the inner wall of the tank is in direct contact with the hot water and may impart to the water a red color which is not only unattractive but also is destructive for washing and laundry purposes. When the color appears there is a complaint and a search for a remedy.

Experience shows that a satisfactory cure may be obtained at a low cost by either of two simple methods. One is to paint the interior with a thick coat of paint having a bituminous base and specially prepared to resist heat and water action. To apply such a coat properly so it will take hold on the metal and stay put, first drain the tank and rig up an electric blower to blow air in through the manhole to the far end of the tank. A man should then crawl in, scrape out the rust and dirt, and wash the walls till the bare metal is exposed. The tank should be allowed to be dried thoroughly by the fan blast. If there is a steam coil within the tank the steam should be turned on to help dry the tank wall. After the tank is dry, and preferably warmed by the steam coil, the man should crawl in again and thoroughly paint the wall. The fan must be kept running to blow out the paint fumes and furnish a supply of fresh air to the man. After the painting job is finished, the fan and heater coil should be kept running till the paint is dry. Then the fan and its canvas air duct should be removed, the manhole cover put back, and the water turned on. If the right kind of paint is used, and the job is properly done, this method is considered very effective and durable, but it has the disadvantage of leaving the building without a hot water supply if there is not an auxiliary source of hot water supply to carry the building over the tank painting period.

In a case where it is not possible to shut down the hot water supply long enough to paint the tank properly, the other method may be used. This treatment can usually be completed in an hour or two, during the night when no hot water is being drawn. It involves the installation of a device to automatically inject a small quantity of sodium silicate solution into the tank, by recirculation of tank hot water down through the device. The recirculation water dissolves the crystals slowly and conveys the solution into the tank where it mixes with the tank water by local circulation within the tank. In this way the silicate is brought into contact with the wall of the tank where it seems to form a leathery film over the metal face thus separating the water from the metal and so preventing contact between the water and the metal, or its rusted face. The film has been found, perhaps not in every case but in many, to clarify the hot water supply. Should an overdose of sodium silicate ever exist the only noticeable effect seems to be a softening of the water, making it probably better for laundry purposes.

●

*Liberal payment will be made for brief articles which are, in the opinion of the editors, useful and generally applicable kinks relating to drafting room, shop, plant, or field practice in the design, installation, operation, or maintenance of heating, ventilating, or air conditioning equipment. Sketches (in pencil) or photos should be included when necessary.*

## THE MONTHLY QUIZ

**How many of the following teasers can you answer offhand? Only one of the answers given after each question is correct. Check your answers against those appearing on page 57**

**1.** A Wahlen gage is a device for: (1) measuring viscosity of fuel oil; (2) indicating surface resistance to heat flow; (3) measuring low air velocities; (4) determining the dewpoint of air-water mixtures; (5) measuring the coefficient of friction in a duct.

**2.** The hot plate method is used for: (1) determining the heating value of coal; (2) computing the amount of radiant energy; (3) drying hygroscopic materials; (4) determining quantity of heat flow; (5) analyzing non-condensible gases in flue gas.

**3.** Yaw angle is the angle between: (1) the radii of two adjacent blades of a blower; (2) an anemometer and the direction of air flow; (3) spray in an air washer and direction of air flow; (4) the thread and the axis of a stoker screw; (5) a condensate return line pipe and horizontal.

**4.** A decibel is: (1) a fraction whose denominator is 10 or a power of ten; (2) a unit for measuring intensity of sunlight; (3) a unit of sound measurement: (4) a unit of odor intensity; (5) a type of CO recorder.

# Outside Design Temperatures and Wind Data for Winter Heating

The lowest temperatures ever recorded, as shown on the previous map, are of more than interest to the heating engineer. He is concerned about them, for the ideal heating plant from a comfort standpoint would be one which could maintain desired inside conditions in the very coldest weather. However, the extreme low temperature for a city is one attained only once or twice in as long a period as forty to sixty years.

***Selecting the Design Temperature***

Consequently, if a heating plant were designed to meet this unusual condition it would be uneconomical in that there would be an investment in reserve capacity called for too rarely. A temperature somewhat higher than the lowest of record is usually selected. This temperature, logically, should be so chosen that the plant will be of sufficient size to maintain desired inside temperatures during all but the very extreme weather.

Just where this "design" temperature should be set in relation to the lowest recorded temperature has never been determined definitely. One rule is that the outside design temperature for heating should be not more than 15F above the lowest temperature for the preceding ten years, except in massive structures where the heat lag will carry the building over short periods of cold weather. This rule is, however, not sufficiently delimiting so as to enable setting the design temperature closely.

***Basis of Map***

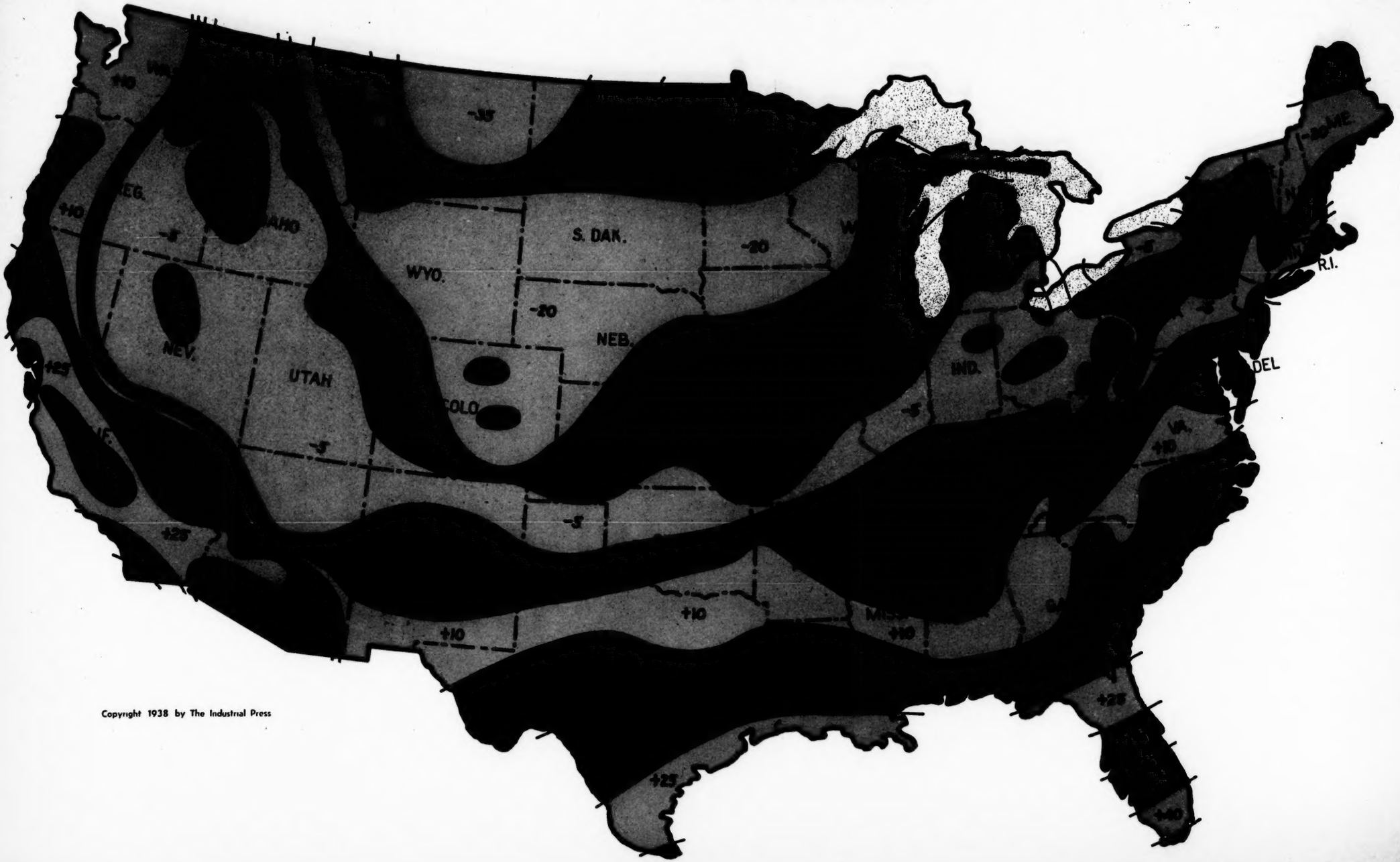
Another rule is that the design temperature "shall be that minimum temperature which has been recorded on more than 2% of the days when heating is required." This definition is that of the Air Conditioning Manufacturers Association and the accompanying map and design temperatures in the table are from the ACMA application code, and presumably have been arrived at on the basis of the definition quoted.

***Importance of Wind Data***

A severe heating load results when a combination of extremely low temperature and high wind velocity occurs simultaneously. It would be highly desirable to have information on the wind velocities which have prevailed at the time of very low temperatures, as it has already been shown that there is some evidence that high wind velocities may frequently accompany very low temperatures. However, data are lacking on this phase of design for all but a few cities.

In place of these data, average wind velocities are often averaged for the three coldest months—December, January, and February—covering a long period. This average differs only slightly from the January average so that this latter figure is presented in the table, together with the direction of the prevailing January wind. The velocity

# OUTSIDE DESIGN TEMPERATURES FOR WINTER HEATING

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# OUTSIDE DESIGN TEMPERATURES AND WIND DATA FOR WINTER IN 100 CITIES

| City | Design Temp., F | Av. Jan. Wind Vel. (m.p.h.) and Dir. |
|---|---|---|
| Albany, New York | −5 | 8.6 S |
| Albuquerque, New Mexico | 5 | 7.3 N |
| Atlanta, Georgia | 10 | 11.2 NW |
| Baltimore, Maryland | 5 | 7.5 NW |
| Birmingham, Alabama | 5 | 8.7 N |
| Boise, Idaho | 0 | 5.7 SE |
| Boston, Massachusetts | 0 | 11.2 W |
| Buffalo, New York | −5 | 17.6 W |
| Burlington, Vermont | −10 | 12.5 S |
| Butte, Montana | −20 | — |
| Charleston, South Carolina | 20 | 9.8 SW |
| Charlotte, North Carolina | 10 | 6.5 SW |
| Cheyenne, Wyoming | −20 | 13.1 NW |
| Chicago, Illinois | −10 | 12.8 SW |
| Cincinnati, Ohio | −5 | 8.8 SW |
| Cleveland, Ohio | −5 | 13.2 SW |
| Columbia, South Carolina | 15 | 8.3 NE |
| Columbus, Ohio | −10 | 11.8 SW |
| Concord, New Hampshire | −20 | 6.6 NW |
| Dallas, Texas | 10 | 9.7 NW |
| Denver, Colorado | −20 | 8.2 S |
| Des Moines, Iowa | −15 | 8.4 NW |
| Detroit, Michigan | 0 | 12.2 SW |
| Duluth, Minnesota | −25 | 12.2 SW |
| El Paso, Texas | 10 | 9.9 NW |
| Erie, Pennsylvania | 0 | — |
| Eugene, Oregon | 15 | — |
| Evansville, Indiana | 0 | 9.9 S |
| Fitchburg, Massachusetts | −10 | — |
| Flagstaff, Arizona | −15 | 7.5 SW |
| Fort Smith, Arkansas | 10 | 8.7 E |
| Fort Wayne, Indiana | −10 | 10.8 SW |
| Frederick, Maryland | −5 | — |
| Grand Forks, North Dakota | −25 | — |
| Grand Rapids, Michigan | −10 | 8.9 W |
| Great Falls, Montana | −20 | — |
| Greensboro, North Carolina | 15 | — |
| Hartford, Connecticut | −5 | 8.6 NW |
| Houston, Texas | 25 | 9.6 N |
| Huntington, West Virginia | −5 | — |
| Indianapolis, Indiana | −5 | 11.6 SW |
| Jacksonville, Florida | 25 | 9.1 NE |
| Kansas City, Missouri | −5 | 11.9 NW |
| Knoxville, Tennessee | 10 | 7.8 SW |
| Lexington, Kentucky | 0 | 12.8 SW |
| Lincoln, Nebraska | −10 | 10.5 S |
| Little Rock, Arkansas | 5 | 8.7 NW |
| Los Angeles, California | 30 | 5.2 NE |
| Louisville, Kentucky | 0 | 9.8 SW |
| Madison, Wisconsin | −10 | 10.2 NW |
| Memphis, Tennessee | 5 | 9.2 S |
| Meridian, Mississippi | 10 | — |
| Milwaukee, Wisconsin | −10 | 11.4 W |
| Minneapolis, Minnesota | −20 | 11.2 NW |
| Minot, North Dakota | −30 | — |
| Mobile, Alabama | 15 | 8.8 N |
| Newark, New Jersey | 5 | — |
| New Orleans, Louisiana | 25 | 8.8 N |
| New York, New York | 0 | 17.4 NW |
| Norfolk, Virginia | 15 | 10.7 N |
| Oklahoma City, Oklahoma | −5 | 11.7 N |
| Omaha, Nebraska | −10 | 9.3 NW |
| Paterson, New Jersey | −5 | — |
| Pensacola, Florida | 20 | 10.8 N |
| Peoria, Illinois | −10 | 8.6 S |
| Philadelphia, Pennsylvania | 5 | 10.8 NW |
| Phoenix, Arizona | 25 | 5.2 E |
| Pittsburgh, Pennsylvania | −5 | 9.9 W |
| Portland, Maine | −10 | 9.2 NW |
| Portland, Oregon | 15 | 7.3 S |
| Providence, Rhode Island | 0 | 12.9 NW |
| Pueblo, Colorado | −25 | 7.5 NW |
| Reading, Pennsylvania | − 5 | 7.4 NW |
| Reno, Nevada | − 5 | 6.2 W |
| Richmond, Virginia | 10 | 8.7 SW |
| Rochester, New York | −5 | 10.7 W |
| St. Louis, Missouri | −5 | 11.7 S |
| Salt Lake City, Utah | −5 | 7.2 SE |
| San Antonio, Texas | 20 | 8.3 N |
| San Diego, California | 35 | 5.3 NW |
| San Francisco, California | 35 | 7.7 N |
| Savannah, Georgia | 15 | 9.1 NW |
| Scranton, Pennsylvania | −10 | 8.4 SW |
| Seattle, Washington | 10 | 9.8 SE |
| Shreveport, Louisiana | 15 | 8.7 SE |
| Sioux City, Iowa | −20 | 11.8 NW |
| Sioux Falls, South Dakota | −20 | — |
| South Bend, Indiana | −5 | — |
| Spokane, Washington | −10 | 6.2 SW |
| Springfield, Illinois | −10 | 10.1 NW |
| Syracuse, New York | −15 | 12.5 S |
| Topeka, Kansas | −10 | 9.9 S |
| Trenton, New Jersey | 5 | 12.1 NW |
| Tulsa, Oklahoma | −5 | — |
| Vicksburg, Mississippi | 15 | 8.1 SE |
| Washington, District of Columbia | 0 | 7.0 NW |
| Wheeling, West Virginia | −5 | — |
| Wichita, Kansas | −5 | 11.3 S |
| Wilmington, Delaware | 5 | — |
| Yuma, Arizona | 20 | 6.9 N |

Wind directions given indicate the direction from which wind comes, not direction it goes.

given is the average for all days of all Januarys of record, in miles per hour. The direction is the direction from which the wind blew on more days in all the Januarys of record than it blew from any other direction.

The design temperatures as given here are those used in calculating the heat transmission through the walls, roof, glass, and doors. Wind enters into design since it affects the quantity of air leakage through cracks and to some extent through the walls and glass also; in addition, air movement affects the surface resistance to heat transmission by the building materials.

***Wind Figures and Air Leakage***

Coefficients of heat transmission as customarily published are ordinarily calculated on the basis of a 15-mile wind velocity, so that no correction for wind need usually be made on the heat transmission coefficients. The wind velocity figures given in the table are, however, useful in calculating the amount of air leakage through cracks in doors and windows.

In connection with the wind directions given in the table, it should be noted that the prevailing direction may not necessarily apply to a specific building, due to wind obstruction of adjacent buildings.

# EDITORIALS

## Prospects Brighter for Government Program

Encouraging is the news of the month regarding the early operations of the revised FHA plan. It seems that many of the good things urged in favor of this plan by its adherents are coming true. There is reported to be a real demand developing in suburban building, in fact this is said to be the most encouraging spot in the whole business picture at present. It was also announced that more allotments of funds to slum-clearing, low-rent projects had also been made by U. S. Housing Authority. There have always been good possibilities in the government program for aiding the building industry but it has always moved so slowly that many people have had little faith in it. Now there is more experience behind these plans, much demonstration and preliminary work should not have to be repeated. There is also much evidence that the object lessons in the earlier government plans have been learned fairly thoroughly. All in all, the prospects are brighter for this program than they were thirty days ago.

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## Merchandising in Home Heating

Probably no more interesting situation in marketing has come to attention for some time than that which has followed the sudden rise of the stoker to popularity. Several manufacturers who heretofore have made oil burners exclusively have decided to have a try at stokers as well. Curiously enough, several stoker makers have also started to eye the oil burner situation and at least one recently announced his entry into the field of oil burner manufacturing. Many of the marketing organizations have also made arrangements which permit them to put both a stoker and an oil burner in the hands of their selling staffs, and bearing the organization name, even though the nameplate does not reveal the true maker of either the stoker or the burner.

To some extent this is an indication of the increasingly difficult position of the manufacturer of a single product aimed at the home market (and which can be merchandised). He is being more and more forced to face the competition of the large merchandiser who has a full list of products to offer the consumer, and to spread his overhead burden. To meet this the single product marketer attempts to diversify his line. In doing so he loses his specialist status to some extent and himself begins to resemble a merchandiser. Every change in the marketing situation in the home equipment field sees something of this kind take place. In this sense the rise of the stoker is nothing new. It is merely added evidence that there is a growing tendency to separate the single product manufacturer of a merchandisable item from direct marketing to the consumer.

More and more these manufacturers are finding it to their advantage to accept the status of a parts-maker who sells his product to the merchandiser without himself attempting to reach the ultimate user. To what an extent this tendency has been carried in the case of some of the home products in this field can be seen by scanning a list of the makers of home furnaces, home oil burners, home stokers, and home boilers. Unless you have had your attention called to this situation previously you may be surprised to note what is taking place.

Also it is interesting to keep in mind that there are people who are firmly convinced that the great bulk of home heating equipment of all kinds will eventually reach the consumer through a few, perhaps not more than a half dozen, merchandiser-manufacturers. They point to the automobile industry where the list has narrowed down to about that number. It is also interesting to note that none of these people seem ready to hazard a guess as to how soon this will come to pass.

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## No Tax on Fuel Oil

Announcement that the proposed Federal tax on fuel oil used for heating purpose is dead for the present comes as welcome news generally. To the competitors of oil the imposition of the tax might have seemed like a good idea but the placing of a sales tax on fuel should not be judged by competitive considerations. Especially now such a tax should be considered a calamity for with the future search for new tax sources—which search is sure to come—imposition of a tax on one fuel is almost certain to be merely a signal for placing similar taxes on the others. Much of the credit for the successful fight against the tax proposal on oil goes to the Oil Burner Institute which actively campaigned against it. It is to be hoped that the other fuel groups will be equally successful.

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## Self-Contained Air Cooler Prospects

Reports coming from manufacturers of self-contained unit air coolers indicate that a considerable number of them are so thoroughly sold on the possibilities of realizing large volume sales this year that they are laying out the factory production on a big-time basis and are stepping up their production schedules way beyond anything ever before attempted in this kind of equipment. There seems to be a general feeling that this is "the year" for the self-contained cooler. At least a lot is being staked that this is the case. We estimate—and we believe conservatively — that present manufacturing plans call for the production of at least three times as many of these units as last year. They are expected to go largely into offices, judging by comment.

# ABSTRACTS of Current Papers, Books and Pamphlets

## Water Pipe Design Table

The design of piping systems to determine the proper pipe size and pressure loss usually involves the solution of a rather complicated formula. One of the most common formulas in use for this purpose is the Manning formula which when expressed in terms of pipe diameters and discharge is

$$d_1 = \left(\frac{1630Qn}{s^{1/2}}\right)^{3/8}$$

Where $d$ is the inside diameter of the pipe in feet, $Q$ is the discharge in cubic feet per second, $n$ a coefficient depending upon the roughness of the pipe, and $s$ the loss of head due to friction per foot length of pipe.

When the quantity of water flowing and the allowable pressure drop and type of pipe are known the above formula will give the required pipe diameter or if the pipe diameter is known the frictional loss can be determined.

It can be seen that the above formula, because of the frictional exponents, does not lend itself to easy solution. To reduce the labor of computations to an absolute minimum without any sacrifice in the accuracy of results, the author of this book presents a 351-page table giving the solutions of the Manning formula throughout the range of conditions ordinarily encountered in solving pipe problems. The tabulated values give the diameter in inches corresponding to different rates of flow, losses of head and roughness. Rates of flow are given in gallons per minute, cubic feet per second and millions of gallons per day.

The table covers rates of flow from approximately ½ to 4,490,000 g.p.m., roughness coefficients *(n)* from 0.010 to 0.020 and loss in head in feet per foot of length from 0.00002 to 0.05 and pipe diameters from 0.4 to 888 in.

Other tables presented include values of roughness *(n)* for 17 pipe materials, values of $n$ corresponding to values of $C_1 = 100$ in the Hazen-Williams formula, and to values of $C$ in Scobey's formula for wood-stave pipe, concrete pipe, steel pipe and full riveted steel pipe.

[*"Manning Formula Table for the Solution of Pipe Problems," by H. W. King. Published by McGraw-Hill Book Co., Inc., New York. Flexible cover, 6 x 9 in.; 361 pages; price, $5.*]

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## Handbook of Chemistry and Physics

This book is one of the standard works referred to by engineers and scientists for basic scientific information. Its purpose is to present in a condensed form as large an amount of accurate, reliable, and up-to-date information concerning chemistry, physics, and allied sciences as is consistent with convenience in form and possibility of wide use. It is kept up to date by being revised at frequent intervals.

The 22nd edition has about 150 pages of new composition and about 50 pages more than the previous edition. New data of interest to heating and air conditioning engineers cover such subjects as viscosity, vapor pressure, relative humidity tables, and geological data. Subjects covered by the main sections include mathematical tables, properties and physical constants, general chemical tables, specific gravity and properties of matter, heat, hydrometric tables, sound, electricity and magnetism, light, quantities and units, and miscellaneous.

[*"Handbook of Chemistry and Physics," 22nd edition, by Charles D. Hoagman, editor-in-chief. Published by The Chemical Rubber Co., Cleveland, Ohio. Flexible binding; 4¼ x 6½ in.; 2090 pages; price, $6.*]

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## ASHVE Guide, 1938

This year's issue of the American Society of Heating and Ventilating Engineers' Guide differs from the previous issue mainly in the sections relating to cooling. Extensive revisions have been made on the chapters dealing with refrigerants and air drying agents, cooling load determination, and the design of central systems for cooling and dehumidifying.

One entirely new chapter entitled "Air Conditioning in the Treatment of Diseases" is incorporated in this issue. The purpose of this chapter is to outline many of the application requirements found in the medical field.

The chapters which have been rewritten include air pollution, automatic fuel burning equipment, hot water heating systems, air cleaning devices, industrial air conditioning, and pipe and duct installation.

As in the previous edition, the Guide is divided into three main sections, the technical data section, catalog section, and the roll of membership. The technical data section which occupies 840 pages is made up of the following parts: principles, basic data and computation, combustion and utilization of fuel, steam and hot water heating systems, air systems, and general information.

[*"Heating, Ventilating and Air Conditioning Guide," 1938. Published by the American Society of Heating and Ventilating Engineers, 51 Madison Ave., New York. Flexible cover; 6 x 9 in.; 1268 pages; price, $5.*]

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## Financial Survey of Urban Housing

With the attention of the country focused on the necessity of providing adequate housing for the American people, much interest is being shown in the final report of the Financial Survey of Urban Housing recently released by the Department of Commerce. The survey was undertaken to provide information on the economic and financial phases of residential properties in representative American cities. Designed as a coordinate inquiry with the real property inventory, a civil works project, it was conducted in the same cities, as an intensive study of economic factors in housing for a selected sample of the properties for which the general inventory and physical description was provided. The survey was under the general supervision of N. H.

Engle, Assistant Director of the Bureau of Foreign and Domestic Commerce, and David L. Wickens, Project Director.

Much of the preliminary information developed by the survey was released, by individual cities and six summary statements, during 1935. These preliminary releases covered the 61 cities for which sufficient data were obtainable, but the final report covers with much greater detail the data obtainable in 22 selected cities. These 22 cities range in size from Cleveland, Ohio, with a population of over 1,000,000, to Casper, Wyoming, with a population of about 17,000, and represent varying types of economic development, and vary considerably as to age, rate of growth, and geographical location.

In its final form the financial survey of urban housing is, without doubt, the most comprehensive compilation of facts relating to the financial aspects of American housing that has ever been made. Much information is presented on the size, age, and material of structure; on value or rent; on the cost and method of acquisition of homes; the amount, sources, interest rate, and other terms of any credit secured by the property; and the extent of delinquency of rents or loans. Other factors concerning which highly valuable information is presented are related to the family occupying the dwelling unit, the number of persons living there, total income of the family, the amount of income in wages or salaries, and the proportionate time employed. Information on most of these items is presented for each of the years 1930, 1933, and 1934 to provide comparisons at the onset of the depression and at the lowest level of the depression.

[*"Financial Survey of Urban Housing," published by the Department of Commerce, Washington, D. C. Copies may be obtained from the Superintendent of Documents, Washington, D. C.; price, $3.25.*]

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## Anemometers

The customary practice in using a vane anemometer is to mount the instrument so that the axis of rotation of the vane wheel is parallel with the axis of the fan or duct for which measurements are to be made. Usually no attempt is made to determine whether or not the air flow is parallel to the duct or fan axis, it being assumed that no appreciable error is introduced on this account. The Bureau of Standards selected three types of vane anemometers and conducted tests to determine the effect of yaw (the angle between the axis of the instrument and the direction of air flow) on the performance of the three anemometers. Observations were made for angles of yaw within a range of 35° on either side of the zero position. It was found that maximum positive errors of 1, 4, and 5.5% were found for the three instruments when the angle of yaw was approximately 15°. It was also determined that the magnitude of the error depends on the design of the anemometer.

[*"Effect of Yaw on Vane Anemometers," by Roy H. Heald and Paul S. Ballif. National Bureau of Standards, Research paper RP1056. Paper cover; 6 x 9 in.; 8 pages; for sale by the Superintendent of Documents, Washington, D. C.; price, 10 cents.*]

## Toxicity of Industrial Solvent

Such a wide variety of chemicals are in use in industry that it is difficult to determine in all cases which ones are injurious to the health of workers and which are not. Classification is made more difficult by the fact that some substances are poisonous when in low concentrations over long periods. The need for research on the possible effect of such substances on human beings has been felt for a long time.

Now the first step has been taken. This step consists of taking stock of just what is known of the effect of these substances and placing the information in one volume. While the volume does not cover everything on the subject it is for practical purposes sufficiently complete to show the extent of the problem and to serve as an aid to the workers in this field.

The book is divided into eight sections, each section dealing with a group of chemical substances. The titles of sections include the hydrocarbon group; the chloro compounds; alcohols; esters; cyclohexene derivatives; ketones; glycol; and miscellaneous substances. Where possible the following information is given for each of the substances: chemical formula, properties, uses, toxicity, toxic effect on animals, symptoms, toxic effect on man, and references.

[*"Toxicity of Industrial Solvents," compiled by F. O. Browning. Published by Medical Research Council Industrial Research Board, London, England. Cardboard cover; 6 x 9 in.; 382 pages; price, 7s. 6d. net; obtainable in the United States from the British Library of Information, 270 Madison Ave., New York.*]

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## Air Conditioning — Furnaces and Unit Heaters

It is the author's purpose to make this a combination text and reference book on the application of gravity and mechanical furnaces to both summer and winter air conditioning. He has also included such heating devices as electric and unit heaters on the ground that they will furnish warm air for particular applications.

After a general review of the various types of systems now in use the author takes up the fundamental principles such as calculation of transmission coefficients, heat losses and heat gains. Both the B.t.u. and code methods of calculating heat losses are shown.

Typical air conditioning apparatus such as gravity and mechanical furnaces, cooling coils, registers and grilles are shown and explained as to principles, operation, and selection. Sketches and rating tables are included to illustrate the method of equipment selection.

Other subjects discussed include electric heating, humidification, unit heaters, and automatic controls. The last chapter presents a typical example of the design and selection of a complete air conditioning system for a 20-year old house.

This book should prove of help to the beginner who desires to learn something of heating and air conditioning. The many complete examples should be of considerable help to such a person.

[*"Air Conditioning—Furnaces and Unit Heaters," by J. Ralph Dalzell. Published by American Technical Society, Chicago, Ill. Cloth cover; 8½ x 5½ in.; 430 pages; price, $3.*]

# BRIEF REVIEWS

SILICOSIS. This bulletin is an attempt to assemble information in convenient form on the effects of breathing dusts largely in mining and allied industries. The literature on this subject is so extensive that no attempt has been made to include all published material or all types of dust diseases but only to assemble some of the more outstanding data on several aspects of the subject, especially with reference to silicosis. The titles of main sections include: Definition and Classification of Ducts; Exposure to Dust; Physiological Effects of Breathing Dust; Prevention of Dust Diseases; Economic and Legal Aspects of Dust Diseases in Industry; Cost of Compensation for Silicosis; and Bibliography. [*"Review of Literature on Effects of Breathing Dusts with Special Reference to Silicosis," by D. Harrington and Sara J. Davenport. Bulletin 400, Bureau of Mines, U. S. Department of Interior. Paper cover; 6 x 9 in.; 305 pages; price, 25 cents. Obtainable from the Superintendent of Documents, Washington, D. C.*]

COAL ANALYSIS. Description of the standard methods of sampling and analyzing of both coal and coke. This is a revised edition of this standard. [*"Standard Methods of Laboratory Sampling and Analysis of Coal and Coke," ASTM designation: D-271-37, published by the American Society for Testing Materials, 260 S. Broad St., Philadelphia, Pa. Paper cover; 41 pages; 6 x 9 in.; price, 25 cents.*]

STOKER COAL. A study by the Bituminous Coal Research, Inc., to show the extent of segregation that may occur in a power plant coal bunker. Article urges that attention be given to the problem by designers and operators of power plants because of the effect of the variations in the size of coal on stoker performance. [*"Segregation of Coal in an Industrial Steam Plant Bunker," by E. R. Kaiser and R. A. Sherman. Published by "Combustion", 200 Madison Ave., New York, December, 1937; 4 pages.*]

BODY HEAT LOSS. Studies of the heat loss from the human body based on tests in a large respiration calorimeter. Two normal men were studied nude in environments ranging in temperature from 73.4 to 95F. The results show the rates of heat loss by radiation, convection, and vaporization. Also the relation of skin and rectal temperatures with increase in air temperatures. Studies were also made of the chill produced by a lowering of the body temperature. [*"Regulation of Heat Loss from the Human Body," by James D. Hardy and Eugene F. DuBois. Published in the Proceedings of the National Academy of Sciences, Harvard School of Public Health, Boston, Mass., Volume 23, December, 1937, No. 12. Pages 624 to 631.*]

STOKER MANUAL. A series of trouble charts which makes possible a logical analysis of stoker trouble. After trouble is located possible remedies are suggested. Also includes brief information on installation and servicing of the stoker. [*"Herkimer Automatic Heat Coal Burner and Stoker Manual," published by Herkimer Institute of Mechanical Trades, 1819 Broadway, New York. Paper cover; 40 pages, including a stoker complaint and trouble diagram; 4 x 6¾ in.; price, $1.*]

RADIATORS. The purpose of this study was to ascertain the relation of the quantity of heat given off by radiation to that given off by convection from the radiator of the type commonly used for heating buildings. The major conclusions drawn from this analysis are: (1) Radiant heat from a cast-iron radiator may be computed accurately from the Stefan-Boltzmann law, using the envelope of the radiator as the radiating surface, with the surface coefficient for the radiator corresponding to the particular surface involved; (2) radiant heat constitutes between 40 and 50% of the heat emission from the radiator under ordinary circumstances. [*"Heat Emission from Radiators," by K. F. Rubert. Bulletin 24, Engineering Experiment Station, Cornell University, Ithaca, N. Y. Paper cover; 6 x 9 in.; 53 pages; price, 45 cents.*]

LAWS OF BODY HEAT LOSS. The results of a study undertaken to make direct comparisons between the heat loss of the human body and a properly chosen physical object. This study was undertaken because evidence in the past indicated that physical laws of heat loss would not apply directly to the human body. [*"The Physical Laws of Heat Loss from the Human Body," by James D. Hardy. Published in the Proceedings of the National Academy of Sciences, Harvard School of Public Health, Boston, Mass., Volume 23, December, 1937, No. 12. Pages 631 to 637.*]

RESPIRATORS. Discusses the general methods of respirator maintenance, including the individual maintenance and central maintenance systems. Directions and formulas for cleaning and sterlizing respirators in chemical solutions are given, together with instruction for the care and cleaning of filters. The report also gives the latest list of respiratory protective devices holding the Bureau of Mines approval. [*"The Use and Care of Respirators." Preventive Engineering Series, Bulletin No. 2, Part 2. Published by the Air Hygiene Foundation of America, Inc., 4400 Fifth Ave., Pittsburgh, Pa. Paper cover; 6 x 9 in.; 7 pages; available at the above address.*]

BENZOL VAPOR DETERMINATION. Describes the method for determining benzol vapor in the atmosphere and lists apparatus and reagents required for their determination. Describes the procedure for taking samples and for their analysis, either by a volumetric or a calorimetric method. References are given as well as information as to where the necessary apparatus may be obtained. [*"The Determination of Benzol Vapor in the Atmosphere." Preventive Engineering Series, Bulletin No. 2, Part 1. Published by the Air Hygiene Foundation of America, Inc., 4400 Fifth Ave., Pittsburgh, Pa. Paper cover; 6 x 9 in.; 8 pages; available at the above address.*]

OIL HEATING. An analysis of comparative costs of operating a conversion oil burner and oil burner-boiler unit, a gas conversion burner and a gas boiler-burner unit in 20 cities. Comparison is for a house having 300 sq. ft. of steam radiator surface or 480 sq. ft. of hot water or 72,000 B.t.u. of warm air. Also gives information for determining the size of the heating system. [*"Fuel Oil vs. Gas Heat." Compiled by Oil Burner Institute, Rockefeller Center, New York. Paper cover; 5 x 9 in.; 8 pages.*]

# NEWS OF THE MONTH

## Foundries Surveyed in Study of Silicosis in New York State; Great Variations Found in Character of Dust Problem

NEW YORK—Approximately 2.7% of the 12,000 foundry workers in New York State are affected with silicosis, and of this number about 0.7% show signs of tubercular complications, State Industrial Commissioner Elmer F. Andrews and Dr. Leonard Greenburg, executive director, Division of Industrial Hygiene, reveal in a preliminary report on the most searching study of dust in foundries ever attempted by any agency.

Mr. Andrews expressed the opinion that while the silicosis hazard in the foundry industry in this state is existent, it is of a mild degree of severity and may be expected to yield satisfactorily to appropriate measures of control. He pointed out that the incidence of the disease as disclosed by the study is much less frequent than many previous surveys have indicated. He stressed the fact that the foundry industry was selected for investigation not only because its workers are exposed to silica dust, the cause of silicosis, but also because it has the largest number of persons in any single trade exposed to this dust.

Each of the 311 foundries in the state was carefully inspected and of these, 80 were selected for special study. These foundries were carefully chosen with a view to getting a representative cross section of the industry as a whole in terms of the kind of materials cast; that is, whether castings were made of iron, steel, non-ferrous materials or any combination of these —the intensity of exposure to dust, size of foundry, geographical distribution and the like. Approximately 4,169 persons, one-third of all foundry workers in the state, were employed in these 80 foundries.

Of this number 4,066 workers were x-rayed, and a complete occupational history was taken in each case. The kind of work done in the foundry was noted, as well as the total duration of exposure to silica dust—either in the foundry in which the worker was being examined or in other foundries where he had worked previously. In the case of each worker, all of these findings were correlated with the condition found in his lungs as shown by the x-ray picture. Plants and workers were given code numbers and the results of individual examinations have been kept strictly confidential in accordance with an agreement made with the Union.

According to the report, 110 cases of silicosis were discovered in the group of 4,066 persons examined. Of these, 88 or 2.2% were in the first stage; 16 or 0.4% were second stage; and 6 or 0.1% were third stage silicosis. Of the 110 cases 15 or 0.7% showed signs of tuberculosis.

The engineering investigation covering all of the 311 foundries in the state showed that 32 foundries or 9.7% of the total were in good condition as far as the silicosis hazard is concerned; 91 or 27.5% in fair condition; 150 or 45.5% in poor condition; and 57 or 17.3% in bad condition. Great variations were found in the character of the dust problem from one plant to another. The general conclusion was reached that proper plant operation—particularly good "housekeeping"—rather than additional mechanical equipment—would seem to be the most important factor in preventing silicosis in this industry.

General recommendations for foundry dust control, as included in the report, cover building construction and layout, "housekeeping" and rules for the various processes carried on in the industry.

The study which was conducted under the supervision of Doctor Greenburg inaugurates a series of similar studies in the various industries where silicosis hazards exist. The action was stimulated by the passage of an amendment to the Workmen's Compensation Act which made silicosis a compensable disease on and after September 1, 1935.

Commissioner Andrews on January 21 established standards for the testing of wet drilling equipment and wet methods of dust control in rock drilling. Wet drilling in confined areas in class II rock can be used with mechanical ventilation with a maximum rate of air flow through the drill steel at full speed of 2 c.f.m.

## Midwest Stoker Reelects Officers

CHICAGO—The annual meeting of the Midwest Stoker Association, Chicago's local organization of leading stoker sales agencies, was held March, 3 at the Medinah Club.

Other than election of officers for the ensuing year, the meeting was of a routine nature. W. J. O'Neil, sales manager, Chicago branch, Iron Fireman Manufacturing Company, was re-elected president; Mount Burns, sales manager, Chicago branch, Link-Belt Company, was re-elected vice-president; and F. W. Barnholt, sales manager, Chicago branch, Illinois Iron & Bolt Company, was elected secretary-treasurer. These three officers also will serve on the Association's Board of Directors together with E. M. May, Chicago branch manager, Steel Products Engineering Company; and J. J. Hayes, Auburn Stoker Sales Corp.

## Contractors Prepare for Meeting; Theme to Be "Sales for Industry"

NEW YORK—The Heating, Piping and Air Conditioning Contractors National Association will hold its 49th annual convention in Boston, May 31 to June 2. The keynote of the convention will be "Sales for the Industry," according to Frank E. Kise of Cincinnati, chairman of the National Committee. Other members of the Committee are James M. Anderson of Philadelphia and M. J. Chagnard of Louisville.

John H. Zink, chairman of the committee on welding, reports plans to have discussion on qualification of welders and job inspection. Other subjects under consideration will be air conditioning and apprenticeship.

## Laundry Expert Finds Boston Clean

BOSTON—Air of this city is the cleanest in the United States, according to George H. Johnson, director of the department of research and textiles of the Institute of Laundering. He made this statement recently at the New England conference of the institute, before New England and Canadian laundrymen. Boston air, he said, has but 5360 dirt particles per cubic foot, while Pittsburgh has 16,100 particles, and St. Louis, the dirtiest city in the country, 17,600 particles per cubic foot. New York City has 9700 particles, and Washington a trifle less than 7800. In his research, Mr. Johnson found that clothing of persons in big cities of the country has thirty times as many bacteria clinging to it in August as in February, the cleanest month in the year.

## Boston Bureau Hears Valve Experts

CAMBRIDGE, MASS.—Vincent T. Malcolm of the Chapman Valve Co., Indian Orchard, Mass., and A. B. Schellenberg, Alco Valve Co., St. Louis, were the guest speakers at the March meeting of the Air Conditioning Bureau of Boston. The meeting was held at Massachusetts Institute of Technology and was attended by many technical students from around Boston. Mr. Malcolm's subject was Material For Use in Sub-Zero Temperatures. Mr. Schellenberg spoke on Automatic Control of Refrigeration.

## Chicago Adds 16 Conditioning Jobs

CHICAGO — Sixteen air conditioning installations were connected to the lines of the Commonwealth Edison Company during February. These totaled 348½ tons. Two of the installations were in doctors' offices, five in stores, five in restaurants, two in general offices, and two in amusement quarters.

## Census of Manufactures Tabulates Industry Output for 1935; Figures Cover Boilers, Burners, Furnaces, Specialties

WASHINGTON—The Bureau of the Census of the Department of Commerce has released statistics relating to the 1935 production of heating equipment. The figures, which show the comparison between the volume of goods produced in 1935 as compared with that in 1931 and 1929, are from the biennial Census of Manufactures. Following are some of the items reported by the Census for 1935 and 1931:

| EQUIPMENT | 1935 | 1931 |
|---|---|---|
| Cast iron steam and hot water boilers, dollars | 6,257,995 | 9,358,999 |
| Cast iron steam and hot water boilers, number | 64,011 | 99,424 |
| Cast iron steam and hot water boilers, number not reported, dollars | 7,372,844 | 5,057,282 |
| Steel steam and hot water boilers, dollars | 2,496,009 | 3,401,081 |
| Steel steam and hot water boilers, number | 7,770 | 16,864 |
| Parts for heating boilers, dollars | 2,063,372 | 1,240,065 |
| Cast iron radiators, dollars | 12,035,645 | 15,326,304 |
| Nonferrous radiators, dollars, | 993,921 | 1,339,379 |
| Gas and oil-fired radiators, dollars | 232,431 | 307,375 |
| Warm-air furnaces, dollars | 14,396,591 | 18,274,414 |
| Warm-air furnaces, number | 211,385 | 207,375 |
| Warm-air furnaces, number not reported, dollars | 2,080,799 | — |
| Warm-air furnace parts and registers, dollars | 6,330,969 | 6,367,173 |
| Unit heaters, dollars | 2,483,503 | 3,531,339 |
| Unit heaters, number | 18,067 | 20,255 |
| Unit heaters, number not reported, dollars | 2,039,223 | 1,635,531 |
| Mechanical draft oil burners, dollars | 12,451,079 | 14,945,314 |
| Mechanical draft oil burners, number | 112,870 | 86,011 |
| Mechanical draft oil burners, number not reported, dollars | 1,577,571 | — |
| Oil burner-boiler units, dollars | 2,447,968 | — |
| Oil burner-boiler units, number | 9,835 | — |
| Oil burner-boiler units, number not reported, dollars | 325,509 | — |
| Oil burner-furnace units, dollars | 1,003,959 | — |
| Oil burner-furnace units, number | 3,710 | — |
| Gas boilers, number | 23,316 | — |
| Valves and fittings, dollars | 45,028,520 | 37,474,967 |
| Thermostats, dollars | 12,294,011 | 7,913,344 |
| Thermostats, number* | 7,927,236 | 1,169,800 |
| Thermostats, number not reported, dollars | 3,494,962 | 3,532,227 |
| Regulators, dollars | 2,372,694 | 2,574,227 |
| Traps, dollars | 2 143,560 | 2,799,208 |
| Other specialties, dollars | 3,615,634 | 5,623,750 |

*Note: Includes those for cooling apparatus as well as for heating.

## Jenney Elected by Ontario Chapter

TORONTO, ONT.—Sixty-seven members and guests attended the March meeting of the Ontario chapter, ASHVE, which was held recently in the Royal York Hotel. The principal speaker for the evening was A. L. Waines, who gave a lecture on "Heat" which was prepared by the Johns-Manville Co., and illustrated with talkie pictures.

Following the dinner, G. Dickie, chairman of the nominating committee, announced the election of officers for 1938 as follows: President, H. Jenney; vice-president, H. D. Henion; secretary-treasurer, H. R. Roth; board of Governors, F. Ellis, C. Tasker, and J. W. O'Neill.

Harry Angus reported on the code committee and stated that satisfactory progress was being made.

## Land Resigns; Joins N.Y. State Dept.

NEW YORK — S. Lewis Land, educational director of the Heating, Piping and Air Conditioning Contractors National Association, has severed his connection with the Association to become supervisor of industrial education under the New York State Department of Education. Doctor Land will make his headquarters in Buffalo and will be in charge of this work in the western part of New York State.

## Boland Bill Defeat Pleases Dewey

NEW YORK — Congratulating homeowners, as well as members of the oil burner and allied industries, who vigorously appealed to Washington to defeat the Boland Bill, proposing a tax of 1c. per gallon on fuel oil, Frank H. Dewey, president of Oil Burner Institute, expressed the hope that the overwhelming defeat of this bill would discourage the introduction of similar measures if applied to other industries.

The bill, which it is estimated would have added an average of $21 to the annual fuel bill of each homeowner owning an oil burner, received only 25 favorable votes.

## Canada to Condition Tobacco Barns

CHATHAM, ONT.—The Dominion Department of Agriculture, Ottawa, has decided to provide for the installation of air conditioning equipment in burley tobacco barns at its experimental laboratories in Harrow, near here. It is believed by experts that it might be practical to install in burley tobacco barns air conditioning equipment that would materially assist in the curing of a bright, thin burley leaf which is so much in demand. Tobacco growers throughout western Ontario are showing much interest in the experiments.

## Program for Midwest Conference Released by Armour Tech

CHICAGO—In cooperation with Iowa State College, Purdue University, State University of Iowa, University of Illinois, University of Michigan, and University of Wisconsin, and also with the cooperation of local and national engineering societies, the Armour Institute of Technology will sponsor the forthcoming Midwest Power Conference April 13-15.

The conference will have headquarters at the La Salle Hotel here. Reorganized under academic sponsorship, this conference will be open to all persons interested in the solution of the nation's power problems. These arrangements have been made to provide the freest possible discussion of the technical, economic, and social implications of power usage. It is thought, therefore, that the conference will be of wide interest both to engineers and to power producers, distributors, and consumers.

A group of technical conferences will follow the opening session. Wednesday afternoon, April 13, will be devoted to three conferences on (1) Fuels, (2) Trends in electric power equipment, and (3) Locomotive power units. The conferences on Thursday morning, April 14, will include (1) Developments in stationary power plants, (2) Power measurements, and (3) Valuation of power plants. Thursday afternoon will be devoted to a study of (1) Metals, (2) Problems in the operation of power plants, and (3) Hydro power.

The special program arranged for Friday, April 15, includes an inspection trip to Armour Institute of Technology where two papers on "Heat Energy Costs or B.t.u. Auditing" and "Power Requirements for Residential Air Conditioning" will be presented.

Complete information can be obtained by addressing L. E. Grinter, Dean of the Graduate School at Armour Institute of Technology, who will act as director of the conference.

## Dehydration Subject of ASME Talk

NEW YORK—S. Shoor, engineer with Carrier Corp., addressed the junior group ASME air conditioning seminar at a meeting March 8. Mr. Shoor's subject was Application of Dehydration to Air Conditioning.

He described at some length the silica gel process and more briefly dehumidification with lithium chloride and then, with the aid of slides, showed the process of dehydrating with calcium chloride and also mentioned activated alumina. A number of engineers from Research Corp. were present and amplified Mr. Shoor's remarks dealing with dehumidifying with calcium chloride.

## Small House Systems Described at New York Meeting

NEW YORK—The design of a heating plant for a small house was the subject of the regular monthly meeting of the local chapter of the ASHVE, March 21. Plans for the house were sent to members of the chapter before the meeting, giving dimensions and heat losses which totaled 70,000 B.t.u. per hr., and the members were asked to come prepared to discuss what type heating system should be installed.

Three speakers had been selected before the meeting to present detailed plans for heating the house. Marvin C. Barnum, New York representative of Waterman-Waterbury Co., showed his plans for the house which included a steel warm-air oil-burning furnace complete with humidifier and air filters.

R. L. Stinard, engineering department, New York branch, American Radiator Co., presented plans for heating the house with a one-pipe steam system, including a humidifying device in which the moist air was introduced into the living room. A similar plan of humidifying was used by T. W. Reynolds, secretary of the New York Chapter, in plans he presented for heating the house with a forced hot water plant.

Following the formal presentation of the three plans the meeting was thrown open for a discussion which was lively and participated in by members and guests. About 70 attended.

Announcement was made that the last meeting of the season in May will not be an informal dinner such as has formerly been the custom. Instead a representative of the Federal Bureau of Investigation will speak.

## Small Business Men Now Organized

AKRON, O.—With headquarters here, a New York office at 41 E. 42nd St., and representation in 26 states, the National Small Business Men's Association has been organized for the purpose of mobilizing the influence of small business men the country over so that their rights may be defended and the best interests of the whole country served.

Begun last November, three months before the Washington small business men's conference, this movement is headed by DeWitt M. Emery of this city, who states that the association is concentrating on a simple, commonsense program which urges tax relief, especially repeal of the undistributed profits tax, the taking of government out of business, and convincing assurance that business will not be harassed by the government. This idea should have a wide appeal to business men and, properly supported, should enable small business men at last to have a voice in government.

## 65% R.H. for Crepe Paper Plant

FRAMINGHAM, MASS.—At the Dennison Manufacturing Company's plant here, where millions of yards of colored crepe papers are turned out annually, the paper is kept in an air conditioned room held at 70F and 65% relative humidity. It is checked for weight, thickness, strength, and other properties before being subjected to the dye baths that give it the great variety of colors, the dyestuffs also being checked by means of a color analyzer for strength and variation in shade. The adhesives used in making the crepe paper from rolls of tissue, are also tested for constancy of behavior. Thus air conditioning plays an important part in the manufacture of this universally used product.

## Announces 1938 Research Program

NEW YORK—The 1938 program of research announced by the ASHVE lays renewed emphasis on the need for more highly organized and coordinated studies of the physiological aspects of air conditioning. W. L. Fleischer, chairman of the Society's committee on research, has outlined a long-range study designed to widen the industry's existing knowledge of problems which are becoming more and more vital to the progress of air conditioning.

One of the important phases of the research program will be a more extensive study of sensations of comfort experienced under varying artificial conditions of the atmosphere, especially in summer, and an investigation of methods for cleaning the air.

## First Annual Anthracite Conference Scheduled at Lehigh; 18 Technical Papers to be Presented April 29-30

BETHLEHEM, PA.—Dr. C. C. Williams, president of Lehigh University, announced March 3 that the first Anthracite Conference will be held under Lehigh University auspices April 29-30. The purpose of this Conference, which is expected to become an annual affair, is to survey recent engineering developments in the mining and utilization of anthracite and to bring engineers, educators, members of the industry, and the general public up to date on the rapid technological progress in Pennsylvania's hard coal industry.

Conference Chairman, Dr. Herman Eckfeldt, Professor of Mining Engineering at Lehigh, has arranged for 18 technical papers to be presented at the conference. These will focus interest and consideration of engineers, educators, and the industry's selling forces on the rapid engineering progress being made in production, distribution, automatic burning and consumer economy of anthracite. Additional reports of the utilization of ash, and the nonfuel uses of anthracite will also be included in the two-day discussion.

Papers will be presented by outstanding authorities on the various subjects covered, and at the conclusion of the conference the 18 papers will be published in a single report which will be made available for general reference.

The tentative outline of the technical part of the two-day conference includes:

FRIDAY, APRIL, 29—A.M.

Pennsylvania Anthracite Reserves, Dr. Geo. H. Ashley, State Geologist of Pennsylvania.

Inherent Characteristics of Anthracite, Dr. H. J. Rose, Mellon Institute, Pittsburgh, Pa.

A Resume of the Non-Fuel Uses of Anthracite, Prof. H. G. Turner, State College, Pa.

A New Theory Concerning the Combustion of Anthracite, Prof. E. S. Sinkinson, Lehigh University, Associate Prof. of Fuel Technology.

Some Practical Considerations in Connection with Combustion, A. J. Johnson, Director, Anthracite Industries Laboratory, Primos, Pa.

The Application of Thermostatic Controls to Various Types of Anthracite Equipment, Arnold Michelson, vice-president, Minneapolis-Honeywell Regulator Company.

Magazine or Self-Feeding Boilers for Coal, Wm. Anderson, Spencer Heater Div., Lycoming Mfg. Co.

Domestic Burners (or Stokers) for Anthracite, P. A. Mulcey, Anthracite Industries Laboratory.

An Improved Method of Hand Firing Pennsylvania Anthracite in Commercial Installations, H. J. Littell, Anthracite Institute.

Air Conditioning and Refrigeration, Prof. B. H. Jennings, Assoc. Prof. of Mechanical Engineering, Lehigh University.

Equipment for the Use of Anthracite in Apartment Houses and Semi-Industrial Purposes, Wm. Stein, Combustion Engineering Company.

The Pulverization of Anthracite for Commercial Use, Martin Frish, Foster-Wheeler Corporation.

Anthracite for Power Generation, H. W. Warren, chief engineering, Glen Alden Coal Company.

SATURDAY, APRIL 30—A.M.

The Distribution of Anthracite, Prof. A. Haring, Assoc. Prof. of Economics, Lehigh University.

Domestic Ash Handling, E. T. Selig, Jr., Mellon Institute, Pittsburgh, Pa.

The Use of the Degree-Day Calculations in the Retail Coal Industry, A. F. Duemler, Household Fuel Corporation.

The Relation of the Type of Fuel to the Cleanliness of Communities, W. G. Christy, Hudson County (N.J.), Smoke Abatement Engineer.

Statistical Analysis of the Growth of Pennsylvania Anthracite, Prof. E. C. Bratt, Asst. Prof. of Economics, Lehigh.

**In addition to Dr. C. C. Williams, president of Leigh University, the honorary chairman of the conference will be Frank W. Earnest, Jr., president of Anthracite Industries, Inc. Members of Professor Eckfeldt's committee on arrangements are: Allen J. Johnson, vice-chairman, J. K. Goundie, Prof. Fred V. Larkin, P. A. Mulcey, Dr. H. J. Rose, Prof. B. H. Jennings, W. H. Lesser, J. R. Ray, Prof. Eric Sinkinson and Dean Bradley Stoughton of the College of Engineering, Lehigh University.**

## Blaw-Knox Opens All-Steel Home of Prefabricated Construction

PITTSBURGH—With the opening for public inspection of the first Blaw-Knox all-steel experimental home at Clairton, near the new Irvin Works of Carnegie-Illinois Steel Corp., details of materials and construction were made public. The house is 44 ft. wide by 24 ft. deep, and has a living room, kitchen, utility room, master bedroom, guest bedroom, and bath.

All-steel construction has been employed. The house is built on a foundation of concrete blocks resting on concrete footings. Exterior walls are constructed of standard size insulated panels of wall height, made in prefabricated units either 40 or 20 in. wide. The panels consist of a steel frame of copper-bearing steel channels welded together.

The fabricated panels are delivered ready for erection, with a shop coat of metal priming paint. No cutting is required to form windows or door-ways.

All roof surfaces are completely insulated with 1 in. asphalt impregnated rigid insulation attached to roof, trusses, and cross bracing.

The water, gas, and drainage systems are installed according to code requirements. The plumbing is complete with a wall lavatory, 5-ft. bathtub, vitreous-china toilet, and two section slate composition laundry tubs. The automatic gas water heater has an insulated storage tank. All fixtures have chromium-plated fittings.

Heat is provided by a gas fired heater with filters and humidifier.

The design of wall and roof construction has been conducted to give a maximum of insulation. With a double thickness of 1 in. rigid structural insulation board, separated by an air space on the outside walls and 1 in. insulation on both ceilings and roofs, a heat transmission coefficient of about 0.10 B.t.u. per sq. ft. per deg. per hr. is attained.

## Radiant Heat and Its Measurement Described by McDermott

NEW YORK—Meeting at the Building Trades Club here at the regular March meeting, members of the local section of the ASRE listened to Paul J. McDermott describe "Radiant Energy and its Measurement."

Mr. McDermott, who is connected with the research laboratory of Johns-Manville, first described the theory of radiant energy and outlined the problems involved in attempts to measure it. He also described methods used and some of the instruments which have been developed for the purpose.

An interesting feature of the talk was the demonstration which the speaker gave on a radiometer with the aid of which he showed the actual procedure necessary in measuring radiant energy. Discussion following his talk was directed along the line of the effect of radiant heat on comfort in air conditioned spaces.

## Prof. Larson Addresses Chicagoans on Hot Water Heating

CHICAGO—The March meeting of the Illinois Chapter was the largest of the current season. It was held March 14, at the Brevoort Hotel with 118 present at dinner and 185 in attendance at the meeting.

The speaker of the evening was Prof. G. L. Larson, University of Wisconsin. His subject was "Mechanical Hot Water Heating Systems." Professor Larson gave a general review of hot water as a heating medium, traced the development of the forced circulation system, compared it with the gravity method, and presented various arrangements of piping and other fundamental phases of the subject.

His talk called for considerable discussion, entered into by Messrs. Blanding, Thomas, Lewis, Hattis, Wagner, Lippe, Mertz, Brooke, Raymond, Howatt, Knudsen, Reid, Aeberly, and Shields.

## Alco Glass Evaporator Demonstrated at Pacific Coast Meetings

LOS ANGELES—Refrigeration and service engineers in California and Washington recently had an opportunity to see what goes on inside an evaporator. A. B. Schellenberg, sales manager, Alco Valve Co., St. Louis, while on an extended trip to the coast spoke to several groups on The Automatic Control of Refrigerants, and demonstrated the Alco glass evaporator.

The Alco glass evaporator consists of an evaporator of glass tubing fed by a Thermo valve and connected to a small portable compressor. The evaporator is arranged so that it may be rotated to show the effects of feeding a coil in different positions. This device also makes it possible to observe the action of a refrigerant under varying operating conditions.

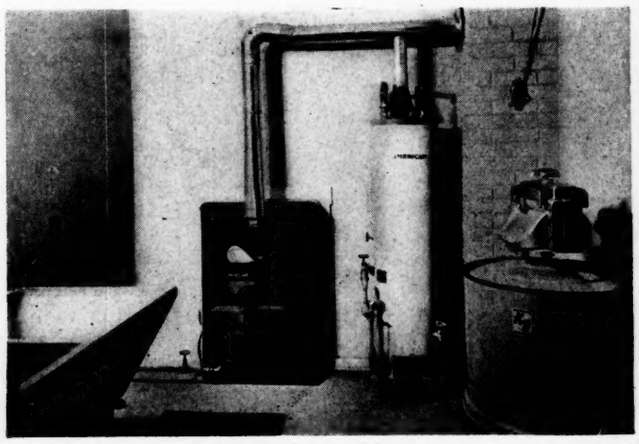
On February 16 a special meeting was held here under the auspices of the Pacific Scientific Co., and the local chapters of the ASRE and ASHVE. The following evening the NAPRE had a banner meeting of 135 men to hear the talk. In San Francisco, 120 members of the NAPRE and ASHVE turned out in a joint meeting to hear Mr. Schellenberg.

Mr. Schellenberg's talks covered briefly the various methods of refrigerant control and explained the operation of the Thermo valve and its relation to evaporator efficiency.

## Rutgers Has New Burner Course

NEW BRUNSWICK, N. J.—To round out its home-study courses in the field of heating and ventilating, Rutgers University is now offering a course in oil burner engineering in 15 sections or lesson assignments. Previously available were the newly-revised air conditioning course and one in heating and ventilating.

Full details of the course may be obtained by addressing the Rutgers University Extension Division, New Brunswick, N. J.



*(Left) Exterior of the first Blaw-Knox all-steel home. (Right) The utility room showing the heating plant and water heater.*

## Court Rules Against Copying of Fan and Decides for Ilg

NEW YORK—In a decision just rendered in the U. S. District Court for the Southern District of New York, the ventilating blower manufactured and sold by the defendant, Evry-Use Products, Inc., has been held to be a Chinese copy of that of the plaintiff, Ilg Electric Ventilating Co., being to a casual observer not distinguishable. Pursuant to the decision of the Court a decree has been entered enjoining and restraining the defendant from the continuance of the manufacture and sale of the blower.

According to the attorney who represented the plaintiff, there was no question of patent or copyright law involved in this action but only the question of unfair competition arising from the manufacture and sale by the defendant of blowers substantially identical in size and general appearance to the plaintiff's blower and possessing the characteristics of the nonfunctional features of the plaintiff's blower, including the same color.

According to the plaintiff's attorney, this decision will, it is believed, be of interest to manufacturers of heavy duty machinery, since it constitutes one of the first cases, where such machines have been protected by injunctive relief against the copying by a competitor of the external shape, appearance and color of such machines and where such protection has been accorded quite independent of any patent rights on such machines in accordance with the established doctrine of unfair competition.

## ASHVE Organizes New Committee

NEW YORK—To encourage the development of comprehensive air conditioning standards designed to protect the health of factory workers without affecting the more precise application of air conditioning to manufacturing processes, is the purpose of a new technical advisory committee on industrial air conditioning of the ASHVE, announced by W. L. Fleisher, chairman of the research committee.

The committee aims to develop unbiased research data from which local governmental agencies and others may prepare and enact sound legislation governing working conditions in air conditioned factories. Industries now requiring high humidities with high temperatures and those wherein the prevalence of dangerous impurities in the form of dust and fumes may constitute an industrial health hazard, will be its chief concern.

The cooperation of health authorities, industrial engineers and manufacturing interests will be sought by the committee. A. E. Stacey, Jr., vice-president, Buensod-Stacey, New York, is chairman of the committee.

## U. S. Housing Authority News

The action of Governor Frank F. Merriam in signing four bills giving the State of California effective housing legislation, leaves only 16 states now having no housing legislation whatever. Alabama, Illinois, Massachusetts and Montana have acts which are held to be incomplete in that they fail to provide for tax exemption or remission of taxes on projects to be constructed under the Wagner-Steagall Housing Act. California is the thirty-second state to enact housing laws providing for the establishment of local housing authorities.

* * *

The 10,085 small-income families now residing in the government's low-rent housing projects pay shelter rents averaging $4.93 per room per month, according to a recapitulation made public March 9.

* * *

A total of $5,900,000 has been set aside by the federal government for Alabama cities to use in clearing slums and blighted areas and the construction of low-rent homes for rehousing slum dwellers. Birmingham has an earmarking of $4,500,000 and Mobile has had $1,400,000 set aside for low-rent housing construction programs.

* * *

With a total of $28,300,000 earmarked for low-rent housing projects in 7 Pennsylvania cities, the Keystone State has assumed a prominent position in the vanguard of the nation's war against slums.

Funds for Pennsylvania, earmarked to date, are as follows:

| | |
|---|---|
| Philadelphia | $12,000,000 |
| Scranton | 1,000,000 |
| McKeesport | 900,000 |
| Pittsburgh | 10,000,000 |
| Allentown | 1,350,000 |
| Chester | 1,250,000 |
| Allegheny County | 1,800,000 |

* * *

On March 17 President Roosevelt approved contracts of loan and annual contributions for low-rent housing and slum-clearance projects in five cities, to provide 3,077 new family dwellings for over 12,000 slum-dwellers. The cities are Austin, Tex., Charleston, S. C., New Orleans, Syracuse, and Youngstown. These contracts are now ready to be signed by the representatives of the localities. When they sign, money can be advanced and work will start.

## Gurney Addresses Texas Chapter on Society's Activities

HOUSTON, TEX.—An outstanding meeting of the Texas chapter, ASHVE, was held at the Rice Hotel, March 5, when 71 members and guests gathered from various cities in the Southwest for dinner with the Society's newly elected president, E. H. Gurney.

A nominating committee composed of C. R. Gardner, Dallas, R. W. Kotzebue, San Antonio, and R. E. Chrone, Houston, was appointed to report to the April meeting a list of nominees for chapter offices for the year.

Mr. Taylor called upon Dr. F. E. Giesecke, director of the Texas Engineering Experiment Station and second vice-president of the ASHVE to present President Gurney to the chapter. President Gurney's discussion of the manner in which the new "Guide" was compiled, the Society's set-up for research, and the results of the meeting of the chapter delegates at the annual convention in New York was exceptionally interesting and well received.

## ANSWERS TO QUESTIONS ON PAGE 44

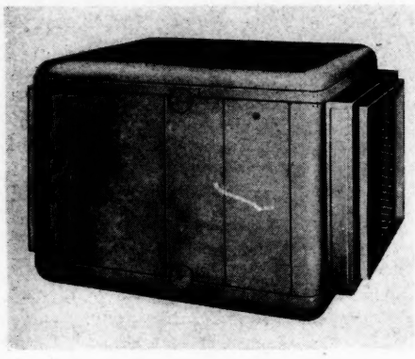
1. The Wahlen gage was developed by a research engineer of that name at the University of Illinois during the early days of the investigational work on warm air furnaces. A device for measuring low air velocities was needed to indicate the relatively slow air motion resulting from gravity flow. The device is a two-liquid (alcohol and kerosene) differential gage. Answer (3) is correct.

2. The hot plate method is one of a number of methods used for measuring heat transmission. A hot plate, to which a known quantity of heat is supplied, loses its heat through two test blanks of the material being measured, one blank on either side. From the rate heat is supplied, the unit heat flow or transmission can be computed, so that (4) is the correct answer.

3. Yaw angle is the angle in a horizontal plane between the axis of an anemometer and the direction of air flow. The angle should be 0°. An error of 5% is possible when the yaw angle is 15°. Correct answer is (2).

4. A decibel is the standard unit for measuring sound intensity. One decibel is a measure of the slightest change in loudness that the human ear can detect, and is equal to ten times the log (base e) of the ratio of the sound intensities. (3) is correct.

# NEW EQUIPMENT

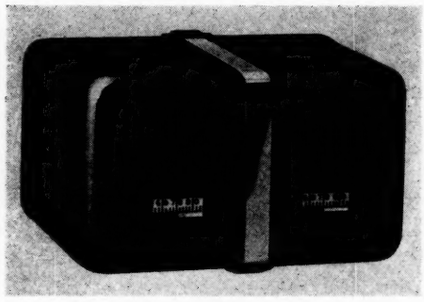


### Trane Humidifying Conditioner

NAME — Trane humidifying conditioner.
PURPOSE—For humidifying and tempering air.
FEATURES—This device has a capacity of 300 c.f.m. of air which is said to be sufficient for an average seven- or eight-room house. It is constructed of 18-gage quality steel sprayed with a rust-resisting paint. An extended surface coil with tubes expanded to fins is used for tempering. A four-blade propeller fan is used to force the air through the unit. Humidification is provided by a target type spray nozzle. Air filter to clean the air is of the throw-away type. Humidifying conditioner requires connection to existing heating system whether steam or hot water and to a water supply and waste line. Unit is housed in a steel cabinet coated with gun metal enamel and can be suspended from a basement joist. One supply and one return duct to the room above are usually enough.
LITERATURE AVAILABLE—Bulletin No. 273.
MADE BY—*The Trane Co., La Crosse, Wis.*.....1

### Barber-Colman Thermostat

NAME—Supertherm.
PURPOSE—For controlling the operation of heating equipment to give a predetermined room temperature.
FEATURES—This thermostat is designed to be mounted on the wall with the long dimension horizontal rather than vertical. The manufacturer states that this horizontal design produces a thermostat with a rapid response. The bimetallic element is also mounted in a horizontal plane so as to present the largest surface of the element to the vertical movement of air which is most prevalent in the room. The two horizontal windows in the front of the instrument carry the adjusting scale and the thermometer. The liquid type thermometer lies horizontal in the left window and the adjusting scale is in



the right window. The adjusting pointer is made of a slider of red bakelite, thus giving an appearance similar to the rising liquid in the thermometer at the left. This instrument may be used in two- or three-wire circuits and is available with or without heat anticipating features, with or without detents giving snap action or floating action. All instruments are equipped with locking shoes which allow the adjusting lever to be locked in any position or locked against a high or low limit position. The Supertherm is housed in a bakelite case with metal bands covering the mounting screws. Standard color is black bakelite with polished stainless steel band, but special colors are available on order.
MADE BY—*Barber-Colman Co., Rockford, Ill.*.....2

### Cruikshank Stokerless Boiler

NAME AND MODEL NUMBER—Imp stokerless boiler, Models 720 and 723.
PURPOSE—For generating steam and hot water using buckwheat and rice sizes of anthracite.
FEATURES — Boiler consists of a water-jacketed funnel shaped coal magazine or hopper having its spout directly over the rotating grate. A section of the spout is cut away and the periphery has a spiral shape terminating in a heel. As the grate rotates fresh coal feeds through the slot and the entire fuel bed is pushed outward due to the shape of the stationary spout. The ash is discharged from the edge of the grate and falls into cans placed in the base of the boiler. Boiler is of welded steel construction and consists of three horizontal pieces concentric with the burner. The mechanism may readily be removed and replaced as a unit, including the entire retort. The coal feed is controlled by the rotational speed of the grate, which may be varied by means of a gear of special shape which meshes with any one of a number of concentric gears cast in the face of a rotating plate on the drive shaft.
SIZES AND CAPACITIES—Six sizes with capacities ranging from 700 to 2250 sq. ft. E.D.R. hot water and from 420 to 1350 sq. ft. E.D.R. steam.
MADE BY — *The V. M. Cruikshank Utilities, Sunbury, Pa.*.....3

## TO OBTAIN FURTHER INFORMATION ON NEW EQUIPMENT

**On the list below circle the item number of the equipment in which you are interested, using the identifying number found at the end of each description**

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23
24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43

**Fill in your name and address, detach and mail to**
**HEATING & VENTILATING**
**148 Lafayette St.,**
**New York, N. Y.**

Name .....

Title .....

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Business Address .....

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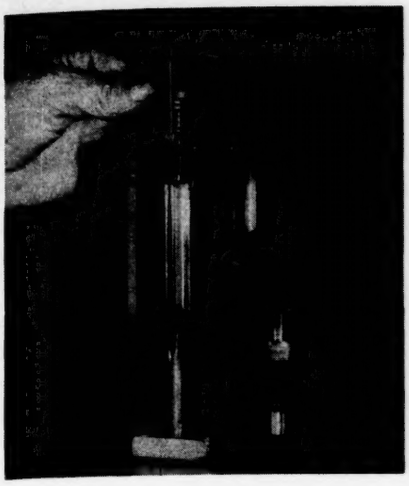
City and State .....

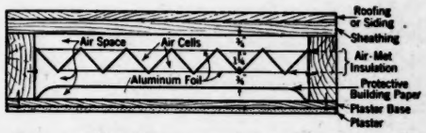


## Dwyer $CO_2$ Analyzer

NAME—Dwyer pocket $CO_2$ indicator.
PURPOSE—For determining the concentration of $CO_2$ in gases.
FEATURES—It is said that this indicator can be easily carried in a coat pocket and that it weighs less than 3 lb. The body of the instrument is made of a transparent plastic which is said to be unaffected by the caustic solution used in the indicator. No glass is used on the entire instrument.
METHOD OF OPERATION—Tests are made while the indicator is held in the hand or in the clip which is provided in the carrying case. The gas sample is pumped into the instrument with a dozen strokes of the aspirator bulb while a plunger is held down. The reading is then taken from the mercury column after the adsorbing unit has been raised and lowered.
LITERATURE AVAILABLE — Catalog 700.
MADE BY—*F. W. Dwyer Manufacturing Co., 565 W. Washington Blvd., Chicago*.....4

## Rubberoid Insulation

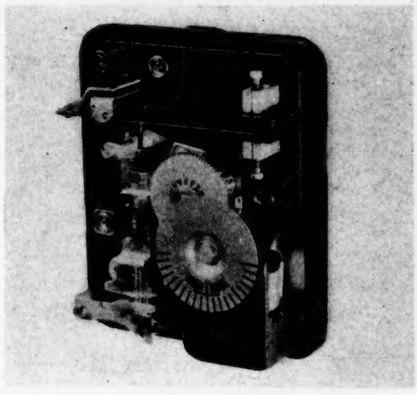
NAME—Air-Met insulation.
PURPOSE—A new type of aluminum foil insulation designed particularly for houses.
FEATURES—This insulation consists of two thin, parallel sheets of aluminum foil spaced about 1 in. apart by a series of triangular air cells of uniform size. Between these two sheets of foil is a light, flameproof member which, by reason of its truss-like design, serves the double purpose of holding the foil sheets parallel and insuring uniformity in size and spacing of the intervening air cells. When properly installed, provision is also made for air space between the outer surfaces of the two sheets of foil and the surrounding building construction. Material is said to be extremely light in weight, 1000 sq. ft. being contained in two small cartons weighing approximately 40 lb. each. Tools required




for application consist of a pair of shears, a hammer, and broad headed tacks or staples. The method of application is merely that of tacking to studs or rafters the flameproof supporting flanges provided for that purpose at both sides of the sheets. The manufacturer states that this insulation will reflect more than 90% of the radiant heat striking its surface.
SIZES—Made in two widths, 15 and 23 in. and in sheets about 80 ft. long which are folded lengthwise like an accordion.
MADE BY—*The Ruberoid Co., 500 Fifth Ave., New York*. .....5

## Barber-Colman Micro-Comfortstat

NAME—Micro-Comfortstat.
PURPOSE—For controlling the effective temperature in a room.
FEATURES—This instrument is similar to the Barber-Colman Comfortstat except that it is equipped with a solenoid device which affords proportion-



ing operation. It is designed especially for use with the Microvalve or Microtrol and is said to give complete proportioning throughout its range.
MADE BY—*Barber-Colman Co., Rockford, Ill.* .....6

## Airtemp Winter Air Conditioners

NAME AND MODEL NUMBER—Winter air conditioners, Models OF-100 and GF-100.
PURPOSE—For winter air conditioning using either oil or gas as a fuel.
FEATURES—Model GF-100 was designed for use with gas while OF-100 is designed for oil firing. Both units have primary and secondary heating surfaces constructed of cold rolled copper bearing steel. A suspended firing box is used in both units to prevent wasteful heat losses to the basement floor. Air can pass completely around the firebox, coming in contact with all sides of the combustion chamber. An adjustable humidifier is provided to

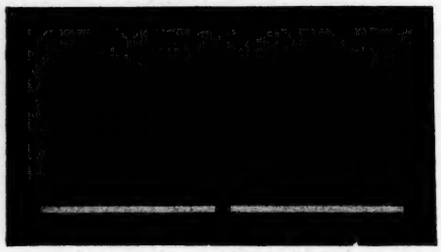
supply necessary moisture to the air. Replacement type oversize filters are employed. The oil-fired model is equipped with an Airtemp oil burner especially designed to match the conditioner, while the gas model is equipped with an Airtemp gas burner. Illustration shows a cut-away view of the direct fired gas unit.
CAPACITIES — Capacities of both units are 100,000 B.t.u. per hr. at the burner with 1200 c.f.m. for the gas unit and 1200 or 1345 c.f.m. for the oil unit.
MADE BY — *Airtemp, Inc., Dayton, Ohio*.....7

## Utica Air Conditioner

NAME—Utica Air Clipper.
PURPOSE—A washed air conditioner for commercial air conditioning.
FEATURES—This model embodies all of the features of air washing as employed in the other Utica air conditioners. A specially designed Utica refrigerating compressor is housed at the bottom of the same cabinet which contains the washing sprays. A new type of intake and discharge header is used on the top for delivery of air in three directions, if desired. Provision is also made for outside air intake connections.
SIZES AND CAPACITIES—Two sizes, 3-ton and 5-ton capacity.
MADE BY — *Utica Radiator Corporation, Utica, N. Y.* .....8

## Furblo Blower

NAME—Furblo blower with a dual motor mounting.
PURPOSE — To enable the user to mount the motor on the top or rear of blower.
FEATURES—Motor can be mounted either on top or at the rear of the blower as the customer desires. It is merely a matter of changing a cross rod from one position to another. This feature is available on the standard Furblo blower in 10, 12, 14, 16, or 20 in. sizes.
LITERATURE AVAILABLE—Form 8-1.
MADE BY—*Furblo Co., Hermansville, Mich*.....9



*Style 145 adjustable-bar register*

## United States Registers

NAME AND MODEL NUMBER—Adjustable-bar registers, Styles 145 and 149.

PURPOSE—An air conditioning register which has a special adjustment to prevent scratching or cutting the finish.

FEATURES—A pin lever operator is used to adjust the register bars to any desired angle of air flow. This lever is inserted through the slot in the mullion of the horizontal design, Style 145, and raises or lowers the

*Style 149 adjustable-bar register*

directional air flow from 60° upflow to 60° downflow or any intervening angle. The Style 149 is mechanically of the same construction but the bars in the face are vertical and work in 50-50 groups. In other words, half swings one way in one group and half swings in another group. These groups can be adjusted to any angle, right or left, by inserting a round rod through the holes in the border.

SIZES AVAILABLE—8 x 6 to 30 x 10 in.

MADE BY—*United States Register Co., Battle Creek, Mich.* .....*10*

## Pocahontas Automatic Stoker

NAME AND MODEL NUMBER—Model HB "O.P." automatic stoker.

PURPOSE—A low-priced coal burner for residential heating.

FEATURES—Stoker is designed primarily for the small home market and burns coking or free burning coal. A streamline hopper is finished in a crinkled sapphire blue. Other features include a chrome nickel retort, built-in air control, 24-in. filling height, 385-lb. hopper capacity, a stoker switch and other controls.

CAPACITIES—From 15 to 50 lb. per hr.

MADE BY—*Pocahontas Fuel Co. Inc., Stoker Division, 1190 E. 152nd St., Cleveland, Ohio.* .....*11*

## Westinghouse Store Air Conditioning Unit

NAME AND MODEL NUMBER—Unitaire SU-90 and SU-135.

PURPOSE—A self-contained air conditioning unit for summer air conditioning of small shops, stores, and offices.

FEATURES—The Unitaire can be located in almost any position in the room to be conditioned and occupies a space approximately 3 ft. wide, 2 ft. deep, and 8 ft. high. Connections required consist of a power outlet, water connection and drain. The unit can be adapted to winter air conditioning by installation of a heating coil and humidifier. Cabinet is finished in a brown crinkle enamel. Motor, compressor, and condenser are hermetically sealed. An adjustable thermostatic control is placed in the center of the cabinet. Two switches permit flexibility of operation, one controlling the cooling mechanism and the other the blower motor only.

SIZES AND CAPACITIES—Two sizes powered with 2½ or 3¼ hp. motors.

MADE BY—*Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.* .....*12*

## Holcomb & Hoke Stoker

NAME AND MODEL NUMBER—Standard FireTender, models 2A and 3½A.

PURPOSE—A low-cost stoker for small and medium size homes.

FEATURES—Streamline hopper with 25-in. fill door, three-speed transmission, oil flow drive unit with Protecto-switch, and self-cleaning tuyeres.

SIZES AND CAPACITIES—Model 2A has 20 lb. per hr. maximum coal burning capacity while 3½A has a 35 lb. per hr. capacity.

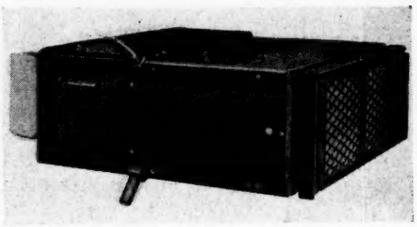
MADE BY—*Holcomb & Hoke Manufacturing Co., 1502 Van Buren St., Indianapolis, Ind.* .....*13*

## G-E Unit Air Conditioners

NAME AND MODEL NO.—Unit assembly air conditioners, Types HD and HC-50B and 100B.

PURPOSE—For furnishing any combination of the following functions: cooling, heating, dehumidifying, humidifying, filtering, circulating, ventilating.

FEATURES—Type HD includes the ten standard units listed for each Type 50B and 100B. Type HC represents specially built units. Each air conditioner consists of three independent

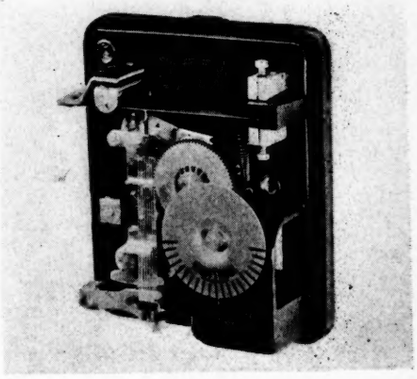


sub-assembly sections, bolted together to form the complete unit. These sections are the frame and enclosure, which houses the heat transfer surfaces and the humidifier; the fan unit, which houses the spring-mounted directly-connected fans; and the filter unit. The fan unit may be assembled to the frame and enclosure to obtain any one of six different arrangements for fan discharge—upward, downward, or horizontally. A novel construction, which eliminates the necessity for a separate drain pan, further simplifies the installation. The heavy sheet steel bottom of the enclosure serves also as a drain pan. The top and bottom of the frame and enclosure are both constructed in the same way, thus making it possible to turn the entire unit upside down to convert from a right-hand to a left-hand assembly. Either direct expansion Freon or water cooling may be employed. Humidifying device is of the screen drip type with galvanized steel wire and brass drip tank. Filters are of the replaceable viscous-coated glass wool type. Electric heating and humidifying attachments are available on order.

CAPACITIES—Cooling, from 12,400 to 40,300 B.t.u. per hr.; heating, from 45,800 to 68,500 B t.u. per hr.; air volume, 630 to 950 c.f.m.

LITERATURE AVAILABLE—Bulletin PM-1021.

MADE BY—*General Electric Co., Schenectady, N. Y.* .....*14*



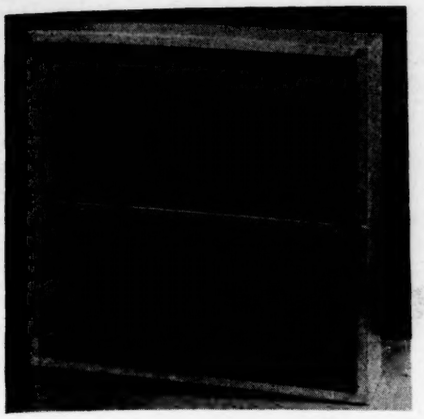
## Barber-Colman Comfortstat

NAME—Comfortstat.

PURPOSE—For maintaining constant effective temperatures by changing the dry bulb temperature in accordance with changes in relative humidity.

FEATURES—This instrument can be set to maintain constant effective temperatures. This is done by varying the dry bulb temperatures so as to give the same effective temperature when the relative humidity changes. The instrument may be used on a three-wire control circuit connected to operate motor-operated valves, relays, damper controllers, and like devices.

MADE BY—*Barber-Colman Co., Rockford, Ill.* .....*15*

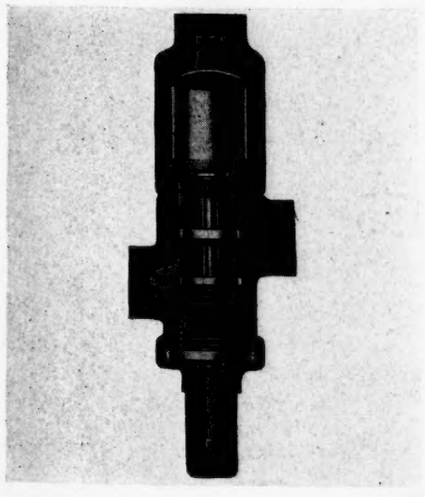


### Staynew Air Filter

NAME—Wire-Klad air filter.
PURPOSE—For air cleaning.
FEATURES — Filter incorporates the Protectomotor principle of construction which affords a large filtering area in relatively small space. Added to the fin is a wire mesh reinforcement which is said to make the filter so strong that it can be cleaned indefinitely by high pressure air or vacuum. Several kinds of filtering media are available. The most usual type is a cotton or a wool felt-like material known as Feltex. If exposure to oil or greasy substances makes cleaning with a solvent necessary, the wire reinforced filter insert can be easily lifted from the frame. When the filter element is worn out, only the wire reinforced filter insert need be replaced. The manufacturer states that the filter is flame resistant.
SIZES—Four standard sizes, 20 x 20, 16 x 20, 16 x 25, and 20 x 25, with three standard depths, 2, 4, and 6 in. Special sizes available.
MADE BY — *Staynew Filter Corp., Rochester, N. Y.* .....*16*

### Sterling Mixing Valve

NAME AND MODEL NUMBER — Sterling mixing valve, types 130 and 140-S.
PURPOSE—Mixing of hot water from domestic water heater with cold water from water supply to give any desired temperature between 120F and the temperature of the water leaving the heater.
FEATURES—Temperature is regulated by a sensitive thermostatic member in the mixing chamber at the top of the valve and it is said that the valve will regulate water temperatures between 3F plus or minus. Model 130 is recommended for water of less than 15 grains hardness, is installed in the hot water line, and regulates the supply of hot water to the cold water line. For water of over 15 grains type 140-S is recommended. This valve is installed in the cold water line only and regulates the supply of cold water to the hot water line. The thermostat for this type of mixing valve is a bulb which is inserted in a domestic hot water service line. This valve can be regulated to any temperature from 140F up to the temperature of the domestic hot water leaving the heater.
MADE BY—*Sterling Engineering Co., 3738 N. Holton St., Milwaukee.* ....*17*

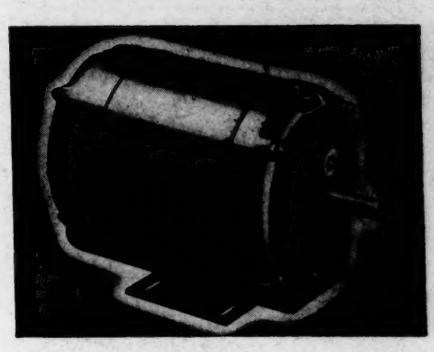


### Ilg Air Supply Unit

NAME—Ilgairator.
PURPOSE—For supplying outside filtered air to rooms.
FEATURES—Unit is designed to be used with any sliding sash window. Made in four adjustable panel widths for various size windows. An air flow regulator provides for the introduction of air in the exact volume desired. A revolvable no-draft grille permits the deflection of fresh air in any desired direction. Electrical consumption is 40 watts per hr. Filter is replaceable. Cabinet is finished in walnut grain.
CAPACITIES—250 cu. ft. per hr.
MADE BY—*Ilg Electric Ventilating Co., Chicago.* .....*18*

### Ohio Belt-Tightening Motor

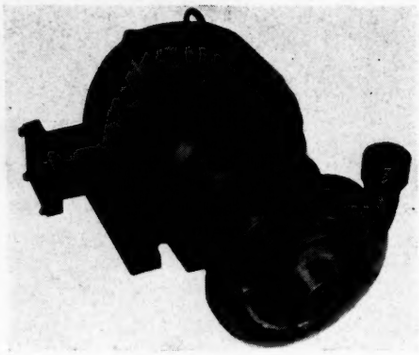
NAME—Belt-tightening motor.
PURPOSE—A resiliently mounted motor especially designed for belt tightening with over-drive belts such as are used for driving furnace blowers.
FEATURES — These motors are equipped with a special belt-tightening design for over-drives where the belt must pull on the top side of the pulley so that air will be driven into the bottom of the furnace. Such belts naturally lengthen after two weeks service



but since this tightener will take up over an inch it is said to save many a failure in service and service calls. The motor is supported above and off the shaft center so that its own weight provides the initial belt tightening effect. This effect is increased proportionally to the load by the reaction of the rotor to the stator causing the motor to swing away from its load and so tighten the belt just the proper amount. Also introduced is a belt tightener without springs for underdrive belts such as are usually employed in driving pumps and compressors. In these the motor is resiliently supported off and below the shaft center. These motors incorporate capacitors and thermal overload cutout switches within the end bell if required. This tends to maintain a smooth streamline effect.
MADE BY — *The Ohio Electric Mfg. Co., 5900 Maurice Ave., Cleveland.* ..*19*

### Sheffler-Gross Oil Strainer

NAME—Duoflo suction oil strainer.
PURPOSE—An oil strainer for use with industrial oil burning equipment.
FEATURES—Device is made of semi-steel and has two perforated baskets held in place by the covers. This duplex construction allows one strainer to be cleaned while the other is in operation. Strainer baskets are large and have a straining capacity greater than that of the intake pipe. When cleaning of one of the strainers is needed it is only necessary to turn the plug cock, deflecting the oil to the other strainer and removing the basket to be cleaned.
SIZES—Five sizes ranging from 1½ to 4 in.
MADE BY—*Sheffler-Gross Co., Inc., 5th & Chestnut Sts., Philadelphia, Pa.*...*20*



### Gardner-Denver Motor Pump

NAME AND MODEL NUMBER—Close-coupled centrifugal motor pump, Type H.

FEATURES—The pump is of the single suction type having a single stage enclosed impeller made of standard bronze. The pump and splashproof motor are mounted together to form a complete unit. Adjustable bearing in the outboard end of the motor compensates for wear between the clearance spaces in the pump. The pumps can be installed in any position, on the floor, wall, or ceiling, and either horizontally or vertically.

SIZES AND CAPACITIES—Up to 250 g.p.m. and heads up to 250 ft.

LITERATURE AVAILABLE—Bulletin A-201.

MADE BY—*Gardner-Denver Co., Quincy, Ill.* .....*21*

### Electrol Air Conditioner

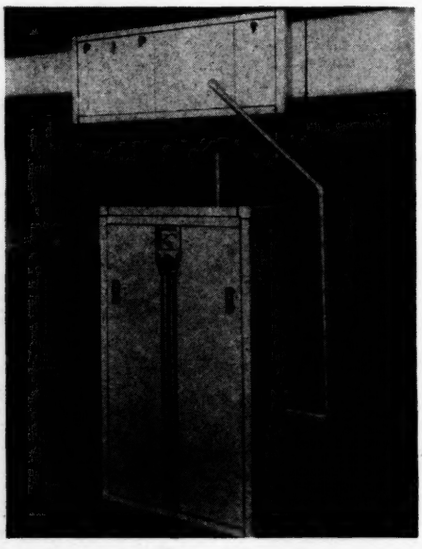
NAME—Suspended split system.

PURPOSE—For humidifying, cleaning, and circulating air during the winter and circulating and cleaning air during the summer. To be used with any automatically oil-fired, steam, or hot water boiler.

FEATURES—This device is designed to be attached to the ceiling in the basement and to supply humidified, filtered, and forced air. A space is provided so that a cold water or refrigeration coil can be installed to provide cooling during warm weather. Unit is finished in a baked enamel.

SIZES AND CAPACITIES—Available in three sizes with capacities ample for conditioning homes up to six or eight rooms.

MADE BY—*Electrol, Inc., 934 Main Ave., Clifton, N. J.* .....*22*

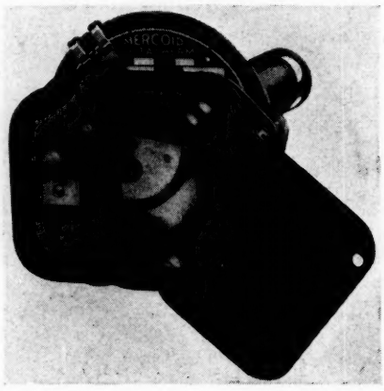


### Mercoid Duct Temperature Control

NAME—Ductatherm.

PURPOSE—For the control of temperatures in air conditioning ducts. Also for limit or fan control for warm air furnaces.

FEATURES—The Ductatherm is said to be small in size and easily adjusted by moving a lever over a calibrated dial to the desired operating setting. Device is actuated by a small bimetal spiral which projects into the duct or chamber where temperature regulation



is required. A magnetic sealed mercury contact switch is used. Device is furnished with a standard flat mounting flange and also with an adjustable flange for slope mounting. Designed for use with 24 volts; ranges 50 to 300F and 250 to 500F.

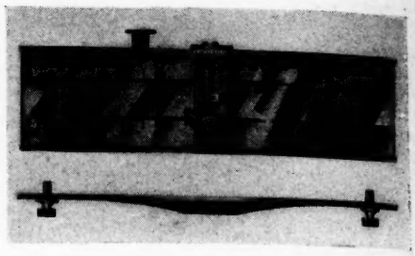
MADE BY—*The Mercoid Corporation, 4201 Belmont Ave., Chicago.* .....*23*

### Detroit Grillometer

NAME AND MODEL NUMBER—Detroit Grillometer, Models DR-5 and DR-20.

PURPOSE—For measuring air velocities from 0 to 2000 f.p.m.

FEATURES—This instrument gives direct readings of air velocities. One feature of the instrument is the brake which may be operated by pressing the button to release the dial and may then be set so that the reading can be taken in dark places. The brake also acts to dampen out the swing of the needle when it is partially released. This is said to be particularly helpful for propeller fan air measurements. Model DR-5 is made for measuring air velocities from 0 to 500 f.p.m. and is said to be useful for checking natural draft, warm air furnaces, return air and



forced heating systems. The plate shown in the illustration is designed to be attached to the Model DR-5 by two thumbscrews to make the Model DR-20 and increase the range on the second scale from 0 to 2000 f.p.m.

MADE BY—*Detroit Air Meter Co., P. O. Box 1473, Detroit, Mich.* .....*24*

### Boiler Room Tempering Valve

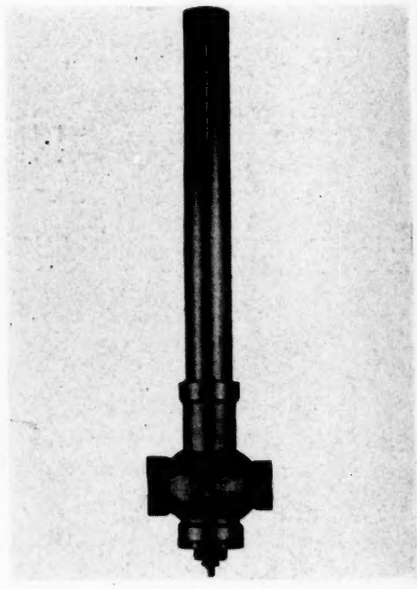
NAME—Holby tempering valve.

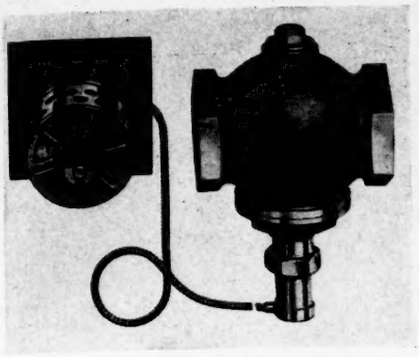
PURPOSE—To regulate the temperature of the hot water in any domestic hot water heating system.

FEATURES—This valve can be adjusted to deliver water at any temperature between 130 and 180F. Valve is entirely constructed of brass and has a long mixing chamber which is said to give a thorough mixing of the cold and hot water. The sensitive parts of the thermostat are inside a non-ferrous tube to protect them against corrosion or scaling action of the water. The action of the thermostat moves a piston over the hot and cold water openings, opening the cold as it reduces the opening of the hot. This action is said to eliminate the building up of temperature in fast circulating systems at times when little or no water is being used.

SIZES—Six sizes ranging from 1 to 3 in.

MADE BY—*Boiler Room Equipment, Inc., 45 W. 45th St., New York*.....*25*



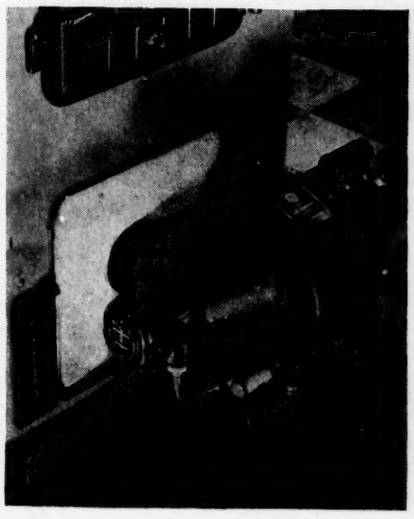


### Sterling Steam Control

NAME AND MODEL NUMBER—Sterling control, type F.
PURPOSE—For controlling the amount of steam that enters blast coils, unit heaters or any type of forced circulation heater.
FEATURES—Operated from thermostat which can be placed as far as 50 ft. from the valve it controls. The thermostat does not have to be placed in the air stream. The valve is of stainless steel and has a stainless steel seat. The device is said to be sensitive to within 2F plus or minus.
SIZES AND CAPACITIES—½ to 3 in., steam pressures from 0 to 50 lb.
LITERATURE AVAILABLE—Bulletin No. 361.
MADE BY—*Sterling Engineering Co., 3738 N. Holton St., Milwaukee.* ....26

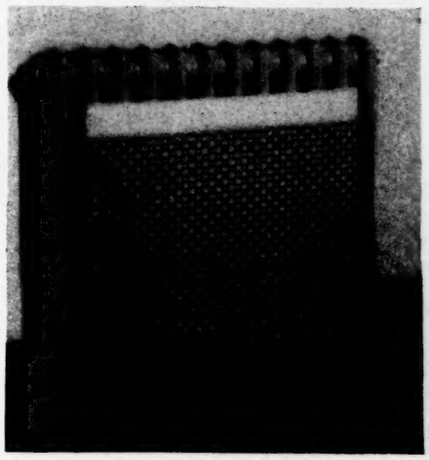
### Iron Fireman Oilburner

NAME—Iron Fireman Oilburner.
PURPOSE—For firing domestic furnaces and boilers.
FEATURES—Burner has a two-stage pump, which not only supplies a stream of oil to the nozzle but also circulates another stream of oil from tank to burner. Constant circulation of oil is said to prevent air-lock. Fuel clogging is said to be reduced to minimum by seven strainers. Mechanical strainer in nozzle is of "washer" type. One-sixth horsepower capacitor motor has automatic shut-off protection against overheating. Motor has resilient mounting, reducing vibration. Motor can be replaced on job. Fan rides a motor shaft sleeve. Cover plate can be removed without dismantling machine. Transformer terminals enclosed within machine for safety. Bus-bars are used to convey current from transformer to contacts. By sliding on slots, the air cone can be adjusted in relation to nozzle.
MADE BY—*Iron Fireman Manufacturing Co., Cleveland.* .....27



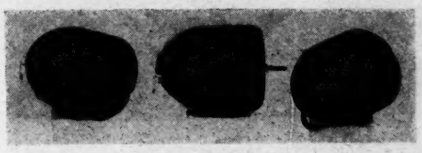
### Lowell Humidifier

NAME—Automatic humidifier.
PURPOSE—For adding moisture to air.
FEATURES—Unit is of a self-filling type and is said to fit any radiator. One unit is required to humidify each room and four units are required for the average home. Supplied with or without grille for an enclosed radiator.
MADE BY—*Lowell Air Conditioning Corp., Architects Bldg., Philadelphia, Pa.*.....28



### Ohio Torpedo-Shaped Motor

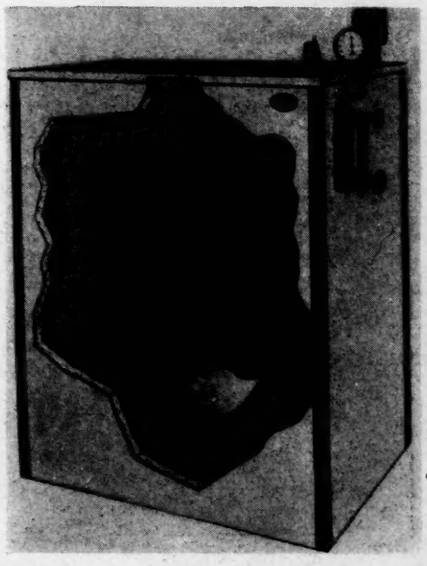
NAME—Ohio torpedo-shaped motor.
PURPOSE—For driving fans, air circulators, unit heaters, and other devices which require a motor of streamline design.
FEATURES—These motors are built with split phase windings for 1150 or 1725 r.p.m. with a start and stop pull switch; also with windings for two speeds, 860 and 1140 or 1140 and 1725 r.p.m. with three-position pull switch. Also built to operate with separate transformer-capacitor control to run at two or three speeds, 1150 and 1725 or 860 and 1150 and 1725 r.p.m. Motors are designed with a barrel frame to facilitate mounting in a ring or yoke. Finishes may either be smooth or crinkle enamel. Bearing housings are incorporated within the lines of the motor and even the oil cups are recessed.

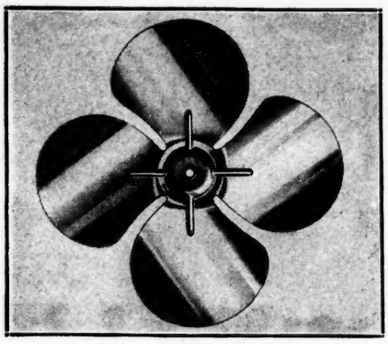


SIZES—Made in three sizes, ⅛ to ¼ hp., to operate fans from 20 to 32 in. in diameter.
MADE BY—*The Ohio Electric Mfg. Co., 5900 Maurice Ave., Cleveland.* ..29

### Coreco Boiler

NAME—Coreco water agitated boiler.
PURPOSE—For supplying steam or hot water using either oil, gas, or coal as a fuel.
FEATURES—Flue gas travel is from the bottom center to the outside and then back to the top center. The water travel is from an "agitator" at the lower cross section to the center where it is then distributed evenly to both sides, then to the steam dome. It is said that steam bubbles forming in the agitator move rapidly upward giving the necessary turbulence required to expose a greater amount of water to the boiler surface. Manufacturer claims that the refractory brick combustion chamber recovers the latent heat during the off firing periods. The boiler is made of grey iron sections assembled by slip nipples and draw bolts. Included with each boiler are high temperature cement and insulation for the combustion chamber, rock wool blankets for boiler insulation and a jacket, trim and all controls. An opening in the rear is said to accommodate any oil or gas burner. Domestic hot water is available from a below-the-water-line heater which is supplied as extra equipment.
SIZES AND CAPACITIES—Nine sizes with steam radiation ratings from 460 to 2350 sq. ft.
MADE BY—*Coreco, Inc., Chandler St. at Bridgman, Buffalo, N. Y.* .....30



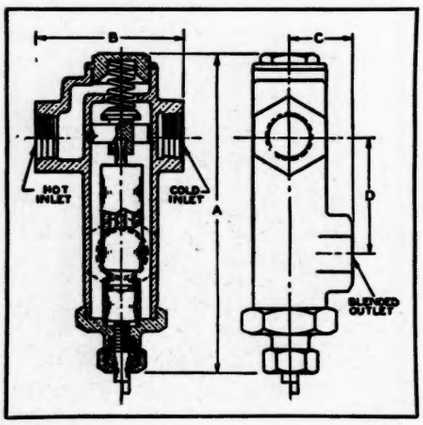


### Torrington Propeller Fan

NAME—12-in. special propeller fan.
PURPOSE—A fan blade designed for use on low powered, inexpensive motors to operate with a minimum of noise.
FEATURES—This fan has a diameter of 12 in. and is made from one piece of aluminum. The company states that the fan blades are quieter than the conventional type which has narrower blades.
CAPACITIES—750 c.f.m. at 1500 r.p.m.
MADE BY—*The Torrington Mfg. Co., 28 Franklin St., Torrington, Conn. . .31*

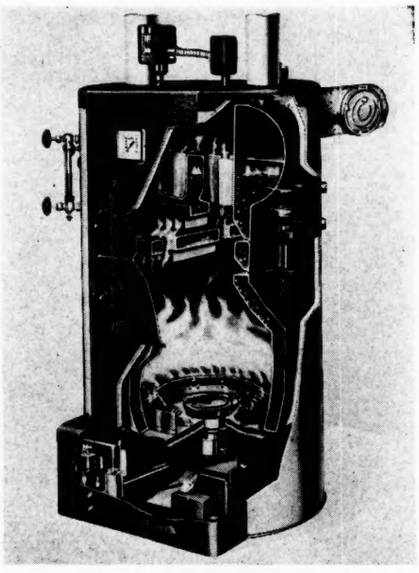
### Sarco Water Blender

NAME AND MODEL NUMBER—Domestic water blender, type DB.
PURPOSE—Mixing valve designed specifically for use on low pressure heating boilers which are equipped with auxiliary hot water heaters.
FEATURES—One inlet of the valve receives the hot water from the boiler or storage tank. Cold water is added to the opposite inlet. The mixed water flows over a Sarco thermostat of the liquid filled type and equipped with a packless seal of Sarco helically corrugated tubing. Water temperature can be regulated between 140F and 180F by means of a special key furnished with the valve. Special ranges built to order. Valve is constructed of brass and bronze.
SIZES—Available in sizes from ½ to 3 in.
MADE BY—*Sarco Company, Inc., 183 Madison Ave., New York. .....32*



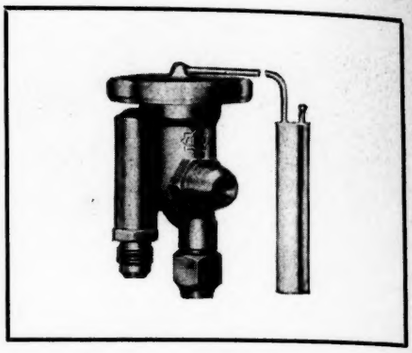

### Timken Oilboiler

NAME AND MODEL NUMBER—Oilboiler Model BAR.
PURPOSE—For supplying steam or hot water for small homes with heating requirements not exceeding 640 sq. ft. of hot water radiator surface or 400 sq. ft. steam radiator surface.
FEATURES—The outstanding feature of this oilboiler is its factory-installed wall-flame oil burner which makes use of a chromium steel flame rim. It is said that this boiler will achieve maximum capacity efficiency within two minutes. Fins are installed for extracting a maximum of heat from the hot gases before entering the chimney.
SIZES AND CAPACITIES—One size with steam rating of 400 e.d.r. and hot water rating of 640 e.d.r.
MADE BY—*Timken Silent Automatic Division, The Timken-Detroit Axle Co., Detroit, Mich. .....33*



### Magnus Oil Sludge Preventor

NAME—Clerex.
PURPOSE—To prevent water and sludge accumulation and stop rusting in fuel oil supply systems.
FEATURES—The manufacturer states that Clerex is an oil soluble penetrating and dispersing agent, crystalline in form. It is claimed to be active in preventing sludge, in oil concentrations between 0.01% and 0.015%. To clear existing sludge the oil is treated with sufficient Clerex to give a concentration of about 0.03% in the oil. It is added to the system by pouring a charge in the tank before filling. Manufacturer also claims that Clerex will gradually dissolve the gum which accumulates on the tank sides and bottom and in the strainers and valves. It is recommended that approximately 1 lb. be used to each 400 gal. to clear out fouled tanks.
MADE BY—*Magnus Chemical Co., 216 South Ave., Garwood, N. J. .....34*

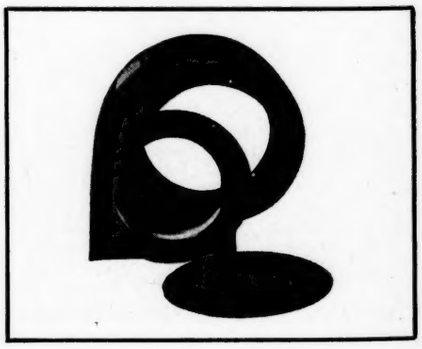


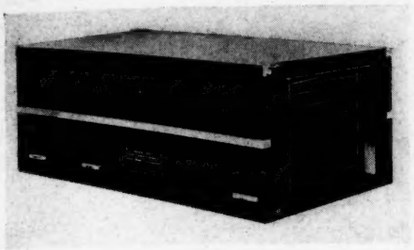
### Alco Thermostatic Expansion Valve

NAME AND MODEL NUMBER—Alco thermostatic expansion valve, Type TK.
PURPOSE—For regulating the flow of Freon or methyl chloride refrigerants to cooling coils.
FEATURES—This valve is the smallest T series valve yet designed by the company. It is constructed of all metal and has a stainless steel diaphragm welded to the metal housing. The manufacturer states that the diaphragm construction is such that the maximum strain of motion is at a point remote from the weld. A large filter is incorporated in the valve.
SIZES AND CAPACITIES—Made in a number of sizes with capacities from 0.3 to 5 tons with a 60-lb. pressure difference across the valve.
MADE BY—*Alco Valve Co., Inc., 2628 Big Bend Blvd., St. Louis, Mo.....35*

### Blow Aire Blower Housings

NAME—Blow Aire blower housings.
PURPOSE—Standard housing for air conditioning and heating fans.
FEATURES—These housings are made in diameters and widths to fit standard blower wheels. They are adaptable to room air conditioning units, kitchen ventilating or individual room duct ventilating, and other applications where a wheel, housing, and motor are used to create a forced draft. The inlet flange and cover plate are interchangeable on either side of the housing for either direction of the wheel.
SIZES—Five sizes to fit standard 4½, 5, 6, 7½, and 9 in. diameter wheels. Also furnished in all widths to suit either single or double inlet wheels.
MADE BY—*Detroit Stamping Co., Detroit, Mich. .....36*





## Modine Air Conditioner

NAME AND MODEL NUMBERS — Apartment house type air conditioners, models 74 and 155.

PURPOSE—A year-round air conditioner for apartments, stores, and residences.

FEATURES—Access doors to the motor, blower, control panel, water valves, heating and cooling coils and humidifying trays are on one side of the unit. All piping and conduit connections are likewise made from this same side. The overall height of the conditioner is 18 in. and the motor and motor drive are completely enclosed in the cabinet. The manufacturer states that because of the above features the Modine unit can be installed with only one side exposed. The rest of the cabinet may be installed flush with the adjoining surfaces. Unit requires connections to hot water or steam heating system and cold water or refrigerant line, as well as to electric lines and a drain.

CAPACITIES — Model 74 heating capacity 74,000 B.t.u. per hr. with 2 lb. steam and cooling capacity 27,300 B.t.u. per hr. with 45F water. Model 155 heating capacity 155,000 B.t.u. per hr. with 2 lb. steam and a cooling capacity 57,500 B.t.u. per hr. with 45F water.

LITERATURE AVAILABLE — Bulletin 638.

MADE BY—*Modine Manufacturing Co., Racine, Wis.* .....37

## Thrush Water Heater

NAME — Thrush Kleen-Tube water heater.

PURPOSE — For supplying domestic hot water utilizing boiler water.

FEATURES—This water heater is made of straight tubes. The use of straight tubes is said to reduce the possibility of lime and sludge deposits in the heater and to make the heater tubes more easily accessible for inspection and cleaning. The heater is designed to be installed in a horizontal position, thus reducing considerably the vertical dimensions of the heater. This increases the normal rate of circulation and is said to make possible increased capacity because the heater can be installed in the highest heat zone of the boiler. All parts of the heater are made of copper or bronze. The heating element consists of drawn seamless copper case, cast iron bronze headers, and drawn seamless copper tubes. These are assembled in a heat exchange unit that is said to be leakproof. It is possible to remove the rear header of the heater without disturbing any of the pipe connections.

MADE BY—*H. A. Thrush & Co., Peru, Ind.*.....38

## Delco-Frigidaire Air Conditioner

NAME — Delco-Frigidaire air conditioner.

PURPOSE—For summer air conditioning of residences, offices, hotels, and hospital rooms.

FEATURES — This room conditioner incorporates the hermetically sealed meter-miser refrigerating unit which is used in this company's refrigerators. The conditioner requires only a connection to the power circuit and fitting to an adjustable window section. The manufacturer states that it can be used with both double sash and casement type windows. A comfort control is provided to govern the cooling effect of the unit and to prevent overcooling. Air direction may be controlled by an air direction selector incorporated on the instrument panel of the unit. All air passing into the room is filtered. The unit is designed to market for $399.50 installed.

CAPACITIES—1300 lb. of ice-melting equivalent per 24 hr.

MADE BY — *Delco-Frigidaire Conditioning Div., General Motors Sales Corp., Dayton, Ohio.* .....39

## Monsanto Insulation

NAME—Santocel.

PURPOSE — A granular or powdered insulation for reducing the flow of heat through building constructions.

FEATURES — Santocel is a so-called silica aerogel; that is, it is a very light porous form of silica having an apparent density of less than 9 lb. per cu. ft. This material is available in either granular or powdered form. Heat transmission coefficients expressed in B.t.u. per hr. per sq. ft. per degree F per in. of thickness are reported as follows:

| Mean Temp. F | K fine | K granular |
|---|---|---|
| 104 | | 0.14 |
| 114 | 0.17 | |
| 253 | 0.20 | |
| 312 | | 0.21 |
| 360 | 0.24 | |

MADE BY — *Monsanto Chemical Co., Merrimac Div., Boston, Mass.* .....40

## Pocahontas Automatic Stoker

NAME AND MODEL NUMBER—Model FB "O.P." automatic stoker.

PURPOSE—A bin-feed automatic stoker for commercial and apartment buildings.

FEATURES—Is designed for use with free burning or coking slack coals. Coal is fed direct from the bin and it is said that the mechanism does not obstruct the firedoor. Other features include chrome nickel retort, variable pitch worm, high tuyeres to provide quick draining of clinkers away from the retort. Stoker is equipped with complete controls and standard wind box.

CAPACITIES — 75 or 100 lb. of coal per hr.

MADE BY—*Pocahontas Fuel Co. Inc., Stoker Division, 1190 E. 152nd St., Cleveland, Ohio.* .....41

## Indian Trailer Room Cooler

NAME AND MODEL NUMBER—Koolroom room cooler, Model 33A-WS.

PURPOSE—A window unit for cooling small rooms.

FEATURES—Unit is designed for installation in windows and requires only an electrical connection. Equipped with a 1/3-hp. motor and circulates 200 cu. ft. of cooled air per min. Retail price is stated to be $175.

CAPACITIES—4000 B.t.u. per hr.

MADE BY—*Indian Trailer Corporation of America, 2338 Indiana Ave., Chicago, Ill.* .....42

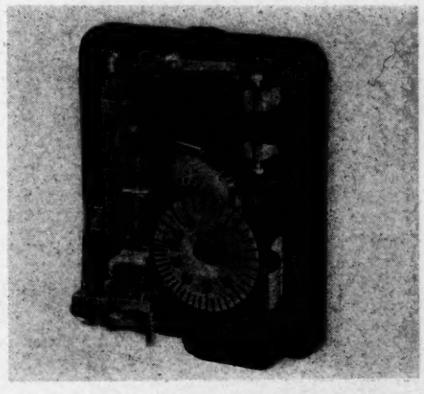
## Barber-Colman Micro-Hygrostat

NAME — Barber-Colman Micro-Hygrostat.

PURPOSE—A proportioning type hygrostat for the control of relative humidity.

FEATURES—This Hygrostat is equipped with a device which affords proportioning operation and is designed for use with the Micro system for the control of Microvalves or Microtrols in order to fully proportion the humidifying control medium.

MADE BY—*Barber-Colman Co., Rockford, Ill.* .....43



# Degree-Day Figures for February, 1938

**HEATING & VENTILATING continues its tenth year of publishing degree-day data for various large cities**

| | Albany, N. Y. | Atlanta, Ga. | Baltimore, Md. | Birmingham, Ala. | Boston, Mass. | Buffalo, N. Y. | Burlington, Vt. |
|---|---|---|---|---|---|---|---|
| Degree-days for February, 1938 ..... | 997 | 380 | 690 | 298 | 964 | 1019 | 1200 |
| Degree-days, Sept. 1, 1937 to Feb. 28, '38 | 4733 | 2451 | 3290 | 2139 | 4306 | 4906 | 5611 |
| Degree-days, Sept. 1, 1936 to Feb. 28, '37 | 4334 | 2058 | 3020 | 1809 | 3906 | 4444 | 5237 |
| Degree-days, Sept. 1, to Feb. 28, Normal | 4868 | 2370 | 3462 | 2023 | 4322 | 4768 | 5496 |

| | Cheyenne, Wyo. | Chicago, Ill. | Cincinnati, Ohio | Cleveland, Ohio | Columbus, Ohio | Denver, Colo. | Des Moines, Iowa |
|---|---|---|---|---|---|---|---|
| Degree-days for February, 1938 ..... | 978 | 853 | 684 | 873 | 759 | 780 | 927 |
| Degree-days, Sept. 1, 1937 to Feb. 28, '38 | 4928 | 4659 | 3902 | 4388 | 4127 | 3829 | 4903 |
| Degree-days, Sept. 1, 1936 to Feb. 28, '37 | 5505 | 4468 | 3630 | 3952 | 3787 | 4534 | 5162 |
| Degree-days, Sept. 1, to Feb. 28, Normal | 5179 | 4582 | 3666 | 4441 | 4113 | 4273 | 4935 |

| | Detroit, Mich. | Dodge City, Kan. | Duluth, Minn. | El Paso, Tex. | Erie, Pa. | Evansville, Ind. | Fort Wayne, Ind. |
|---|---|---|---|---|---|---|---|
| Degree-days for February, 1938 ..... | 944 | 762 | 1310 | 314 | 935 | 549 | 867 |
| Degree-days, Sept. 1, 1937 to Feb. 28, '38 | 4897 | 3704 | 6792 | 1757 | 4607 | 3403 | 4717 |
| Degree-days, Sept. 1, 1936 to Feb. 28, '37 | 4557 | 4179 | 7148 | 2289 | 4091 | 3333 | 4404 |
| Degree-days, Sept. 1, to Feb. 28, Normal | 4718 | 3958 | 6634 | 2101 | 4434 | 3348 | 4503 |

| | Fort Worth, Tex. | Grand Rapids Mich. | Green Bay, Wis. | Harrisburg, Pa. | Hartford, Conn. | Indianapolis, Ind. | Ithaca, N. Y. |
|---|---|---|---|---|---|---|---|
| Degree-days for February, 1938 ..... | 313 | 964 | 1120 | 843 | 938 | 764 | 1012 |
| Degree-days, Sept. 1, 1937 to Feb. 28, '38 | 1866 | 4917 | 5773 | 4039 | 4420 | 4245 | 4862 |
| Degree-days, Sept. 1, 1936 to Feb. 28, '37 | 2215 | 4648 | 5742 | 3714 | 3985 | 3986 | 4546 |
| Degree-days, Sept. 1, to Feb. 28, Normal | 1904 | 4863 | 5778 | 4077 | 4416 | 4099 | 4851 |

| | Kansas City, Mo. | Knoxville, Tenn. | La Crosse, Wis. | Lansing, Mich. | Lincoln, Neb. | Little Rock, Ark. | Los Angeles, Calif. |
|---|---|---|---|---|---|---|---|
| Degree-days for February, 1938 ..... | 751 | 438 | 1062 | 993 | 986 | 397 | 233 |
| Degree-days, Sept. 1, 1937 to Feb. 28, '38 | 3902 | 2889 | 5553 | 5213 | 4516 | 2450 | 601 |
| Degree-days, Sept. 1, 1936 to Feb. 28, '37 | 4064 | 2419 | 5877 | 4972 | 4940 | 2511 | 1066 |
| Degree-days, Sept. 1, to Feb. 28, Normal | 3861 | 2964 | 5578 | 5202 | 4643 | 2380 | 1016 |

| | Louisville, Ky. | Madison, Wis. | Memphis, Tenn. | Milwaukee, Wis. | Minneapolis, Minn. | Nashville, Tenn. | New Haven, Conn. |
|---|---|---|---|---|---|---|---|
| Degree-days for February, 1938 ..... | 584 | 1037 | 382 | 952 | 1208 | 433 | 888 |
| Degree-days, Sept. 1, 1937 to Feb. 28, '38 | 3528 | 5523 | 2493 | 5058 | 5992 | 2892 | 4146 |
| Degree-days, Sept. 1, 1936 to Feb. 28, '37 | 3327 | 5548 | 2496 | 4941 | 6323 | 2658 | 3778 |
| Degree-days, Sept. 1, to Feb. 28, Normal | 3327 | 5557 | 2470 | 5185 | 5950 | 2850 | 4230 |

| | New Orleans, La. | New York, N. Y. | Norfolk, Va. | Oklahoma City, Okla. | Omaha, Neb. | Peoria, Ill. | Philadelphia, Pa. |
|---|---|---|---|---|---|---|---|
| Degree-days for February, 1938 ..... | 157 | 822 | 513 | 547 | 1021 | 807 | 770 |
| Degree-days, Sept. 1, 1937 to Feb. 28, '38 | 1110 | 3760 | 2607 | 2907 | 4780 | 4592 | 3600 |
| Degree-days, Sept. 1, 1936 to Feb. 28, '37 | 830 | 3387 | 2190 | 3203 | 5265 | 4508 | 3237 |
| Degree-days, Sept. 1, to Feb. 28, Normal | 965 | 3869 | 2583 | 2986 | 4765 | 4673 | 3629 |

| | Pittsburgh, Pa. | Portland, Me. | Portland, Oreg. | Providence, R. I. | Reading, Pa. | Reno, Nev. | Richmond, Va. |
|---|---|---|---|---|---|---|---|
| Degree-days for February, 1938 ..... | 751 | 1078 | 607 | 928 | 818 | 893 | 566 |
| Degree-days, Sept. 1, 1937 to Feb. 28, '38 | 4005 | 4937 | 2722 | 4268 | 3846 | 3660 | 3045 |
| Degree-days, Sept. 1, 1936 to Feb. 28, '37 | 3553 | 4577 | 3283 | 3845 | 3537 | 4510 | 2724 |
| Degree-days, Sept. 1, to Feb. 28, Normal | 3947 | 4985 | 3174 | 4316 | 4082 | 4149 | 2935 |

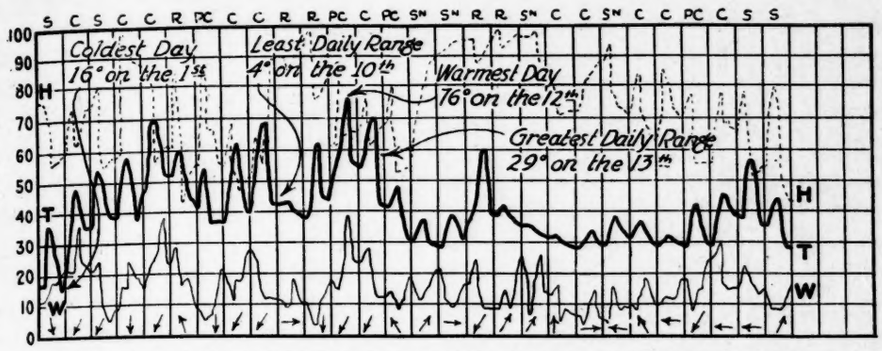
| | Rochester, N. Y. | St. Louis, Mo. | Salt Lake City, Utah | San Francisco, Calif. | Scranton, Pa. | Seattle, Wash. | Spokane, Wash. |
|---|---|---|---|---|---|---|---|
| Degree-days for February, 1938 ..... | 994 | 636 | 727 | 335 | 950 | 573 | 878 |
| Degree-days, Sept. 1, 1937 to Feb. 28, '38 | 4838 | 3662 | 3332 | 1502 | 4526 | 2774 | 4136 |
| Degree-days, Sept. 1, 1936 to Feb. 28, '37 | 4352 | 3646 | 4611 | 1929 | 4138 | 3355 | 5285 |
| Degree-days, Sept. 1, to Feb. 28, Normal | 4825 | 3652 | 4144 | 1770 | 4552 | 3308 | 4707 |

| | Springfield, Ill. | Syracuse, N. Y. | Toledo, Ohio | Trenton, N. J. | Utica, N. Y. | Washington, D. C. | Wichita, Kan. |
|---|---|---|---|---|---|---|---|
| Degree-days for February, 1938 ..... | 725 | 991 | 898 | 824 | 1118 | 675 | 730 |
| Degree-days, Sept. 1, 1937 to Feb. 28, '38 | 4171 | 4717 | 4661 | 3868 | 5193 | 3387 | 3585 |
| Degree-days, Sept. 1, 1936 to Feb. 28, '37 | 4120 | 4317 | 4343 | 3528 | 4580 | 3070 | 3872 |
| Degree-days, Sept. 1, to Feb. 28, Normal | 4191 | 4980 | 4467 | 3715 | 4966 | 3559 | 3773 |

**Methods of applying the degree-day in connection with the operation of heating plants or for the prediction of fuel consumption of heating plants are described fully in the DEGREE-DAY HANDBOOK, published in 1937, by HEATING & VENTILATING, 148 Lafayette Street, New York, price $3. Degree-days as given above for a "normal" month or season are based on averages for a long period of years, ending about 1922. Averages covering different periods will disagree with the above figures slightly.**

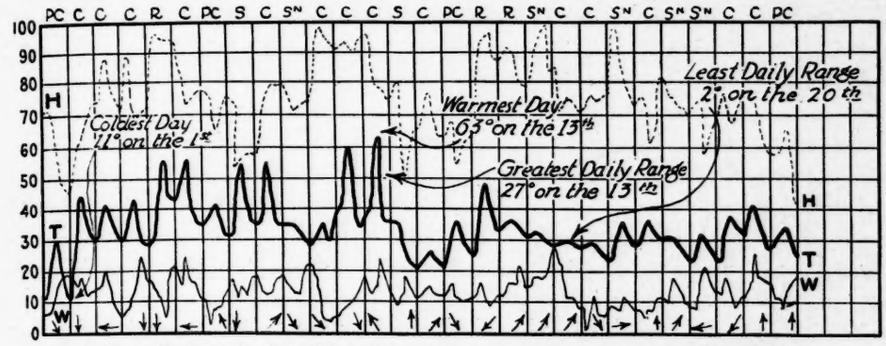
# THE WEATHER FOR FEBRUARY, 1938

Plotted from records compiled for HEATING & VENTILATING by the U. S. Weather Bureau. Heavy curves (T), dry bulb temperatures in deg. F.; dotted lines (H), per cent relative humidity from readings at 8 a.m., noon, and 8 p.m. Light lines (W), wind velocity in m.p.h. Arrows indicate wind direction at maximum velocity, north being arrow pointing up, etc.; S—clear; PC—partly cloudy; C—cloudy; R—rain; Sn—snow.



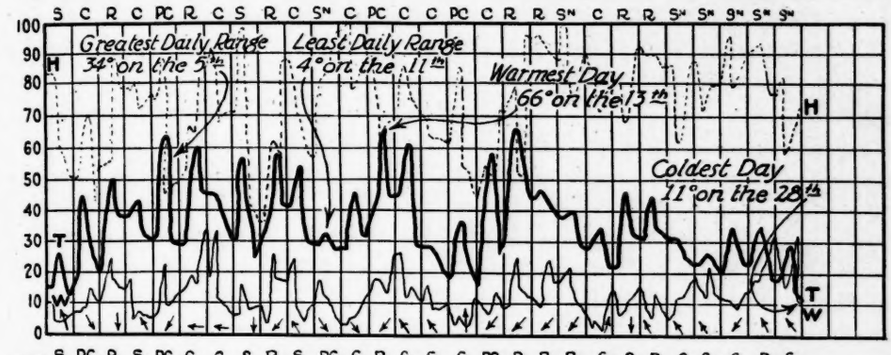

## St. Louis

Mean temp. for month, 42.2F; aver. wind velocity, 14.0 m.p.h.; prevailing direction of wind, SW.



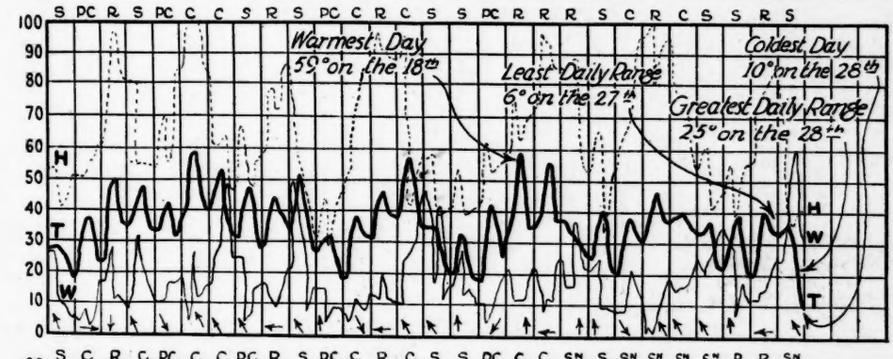

## Chicago

Mean temp. for month, 34.6F; aver. wind velocity, 12.0 m.p.h.; prevailing direction of wind, NE.



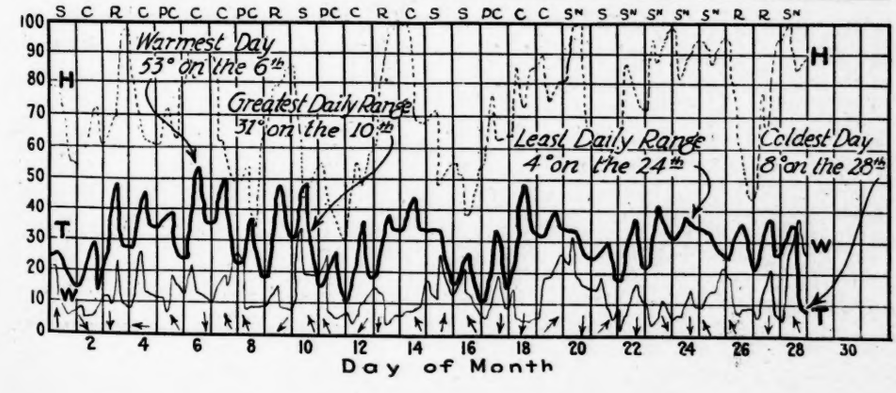

## Pittsburgh

Mean temp. for month, 36.2F; aver. wind velocity, 11.5 m.p.h.; prevailing direction of wind, NW.




## New York

Mean temp. for month, 35.6F; aver. wind velocity, 15.6 m.p.h.; prevailing direction of wind, NW.




## Boston

Mean temp. for month, 30.6F; aver. wind velocity, 11.6 m.p.h.; prevailing direction of wind, NW.

# NEW TRADE LITERATURE

*Air Cleaners.* A standard-size bulletin, No. 274, describing the Type W Roto-Clone which is a combined exhauster and dust separator. Water sprays are incorporated in the device to increase the efficiency. This device is designed for installation on exhaust systems for exhausting the air from such systems and removing the dust. The manufacturer states that the performance characteristics obtained by combining water sprays with dynamic precipitation offer many advantages in the control of heavy dust concentrations or materials of a highly abrasive nature. Bulletin contains performance tables, dimensions, and technical data. AMERICAN AIR FILTER COMPANY, INC., LOUISVILLE, KY. .....44

*Air Conditioning.* A standard-size 16-page catalog, No. CE100, designed to indicate the wide range of Carrier equipment for home, shop, and industry. Includes description of Carrier air conditioning refrigeration and unit heating equipment. Also includes some descriptive and dimensional data. CARRIER CORP., SYRACUSE, N. Y. .....45

*Air Filters.* A small size catalog, No. 8, describing the Trerice air filters designed for filtering compressed air which is used to operate pneumatic types of controls. Gives description of features, principle of operation, and shows typical installation diagrams. H. O. TRERICE CO., 1420 LAFAYETTE BLVD. W., DETROIT, MICH. .....46

*Bearings.* A standard-size, 64-page catalog, No. 380, describing the Johnson Bronze Company's general line of bearings, bushings and bar bronze. Information is given on bronze bearing alloys, tolerance and range of sizes so as to make the catalog helpful in the selection of the correct bearing. Describes Johnson general purpose bearings, universal bronze cored and solid bars, electric motor service bearings, lead base and tin base babbitt, bronze graphited bearings and plug type bearings. JOHNSON BRONZE CO., NEW CASTLE, PA.....47

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**148 Lafayette St.,**
**New York, N. Y.**

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 44 | 45 | 46 | 47 | 48 | 49 | 50 | 51 | 52 |
| 53 | 54 | 55 | 56 | 57 | 58 | 59 | 60 | 61 |

**Name** .....

**Title** .....

**Firm** .....

**Business Address** .....

**City and State** ..... 4/38

*Controls.* A standard-size, 36-page condensed catalog, No. 100, of the Genuine Detroit automatic controls and equipment for use with heating, refrigeration, and air conditioning devices. Gives a brief description of the features of this equipment together with specifications and list prices. DETROIT LUBRICATOR CO., DETROIT, MICH. .....48

*Expansion Joints.* A standard-size bulletin No. 100, illustrating and describing briefly the various kinds of Badger packless expansion joints. Gives information on the history of this type of joint, improvements brought out by Badger engineers, how to select the right type of self-equalizing joint for a given pressure, as well as list prices, dimensions, and weights of all Badger Directed Flexing, Self-Equalizing expansion joints of copper and stainless steel. E. B BADGER & SONS CO., BOSTON, MASS. .....49

*Filters.* A standard-size, eight-page bulletin No. K-120, on the Kompak air filters. Gives information on the construction, servicing, and mechanical features of this line of removable dry fabric filters. Also gives engineering data and suggested specifications. INDEPENDENT AIR FILTER CO., INC., 228 N. LA SALLE ST., CHICAGO. .....50

*Firebrick.* A small illustrated leaflet describing the advantages of B&W insulating firebrick in household burner installations. Among the features described are quick response to thermostat, lower fuel consumption, quiet operation, and cleanliness. A description of the B&W precast combustion chamber is included. THE BABCOCK & WILCOX CO., REFRACTORIES DIV., 19 RECTOR ST. NEW YORK. .....51

*Heating Systems.* Two four-page catalogs describing the Thrush Flow Control balanced single-main system and the Thrush Flow Control system with Kleen-Tube water heater. The first pamphlet on the single-main system shows a number of typical layouts together with pipe sizes and a list of the Thrush specialties used with the system. The second bulletin on the Kleen-Tube water heater discusses the features and construction of the heater and presents installation diagram and capacity tables. H. A. THRUSH & CO., PERU, IND. .....52

*Hot Water Convectors.* A four-page standard-size catalog, No. 4138, describing the type H convectors for forced hot water. Gives capacity tables, a conversion chart for determining capacities at various water temperatures, and roughing-in dimensions. YOUNG RADIATOR CO., RACINE, WIS. .....53

*Industrial Safety Devices.* A standard-size, 34-page catalog describing the complete Willson line of eye, nose, throat and lung protectors. Included are goggles for all purposes, welding handshields and helmets, U. S. Bureau of Mines approved types of dust respirators, air line respirators, abrasive helmets, and like equipment. WILLSON PRODUCTS, INC., 332 THORN ST., READING, PA. .....54

*Insulation.* A standard-size catalog, No. HI-100, describing the Ehret 85% magnesia insulation. This catalog has been prepared to assist users of heat insulations in solving their problems. First few pages are

*(Continued on page 70)*

# FROM *Pigs* TO PIGS

★"Modern" applies today to farms as well as cities--and *steel* has made this true. A sizeable percentage of the "pigs" (masses of metal cast in a mold) from all blast furnaces find their way to the farms in the form of steel---in plows and in modern equipment which increases production; granaries that protect the harvest; pipe, pumps and troughs by which animals are fed and watered.

On an average farm are hundreds of uses for steel. Look around your home--whether farm or city--and note how much you, too, depend on steel --hinges, stoves, cooking utensils, refrigerator, plumbing, heating and countless other uses.

Not, of course, just any steel. There are actually thousands of kinds of steel, and we have spent years and millions of dollars to equip ourselves to work with you, to find which will exactly meet your needs. No matter how small the order may be every Youngstown resource for quality is employed in its production.

**THE YOUNGSTOWN SHEET AND TUBE COMPANY**
Manufacturers of Carbon and Alloy Steels
General Offices - YOUNGSTOWN, OHIO

QUALITY · YOUNGSTOWN · SERVICE

Sheets - Plates - Pipe and Tubular Products - Conduit
Tin Plate - Bars - Rods - Wire - Nails - Unions - Tie
Plates and Spikes.

25-6A

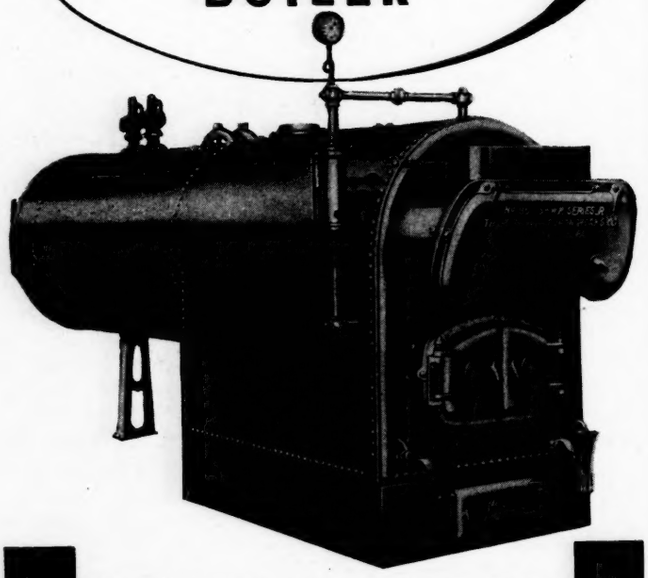
# YOUNGSTOWN

FOR DEPENDABLE POWER & HEAT

You can't beat the...

TITUSVILLE

Series "R-P"
RIVETED
HIGH PRESSURE
BOILER



Designed in strict accordance with the latest ASME Code and thoroughly inspected during their entire construction by a representative of the Hartford Steam Boiler Inspection and Insurance Company, Titusville Portable Return Tubular Firebox Boilers Series "RP" are 100 per cent dependable. Available for 100 to 150 lbs. pressure in all standard sizes. Ask for Bulletin No. 9090.

The TITUSVILLE IRON WORKS CO.
Division of Struthers-Wells Titusville Corporation
TITUSVILLE, PA.

*(Concluded from page 68)*

devoted to description of the physical properties and insulating characteristics of various heat insulating materials. Remainder covers the Ehret 85% magnesia. Insulating and physical characteristics are given as well as dimensions and packaging information on various shapes, sizes and forms. EHRET MAGNESIA MANUFACTURING CO., VALLEY FORGE, PA. .....55

*Radiators.* A standard-size catalog entitled "Crane Radiation." Contains complete ratings and dimensions of Crane direct radiators, as well as other information on sealed radiators, invisible shields, convectors and enclosures, valves, fittings and accessories. CRANE CO., CHICAGO. .....56

*Refrigerant Controls.* A standard-size catalog, No. 15, describing the Alco line of thermostatic expansion valves, automatic expansion valves, magnetic stop valves, float switches, and float valves. Catalog contains a discussion of why close control is important in refrigerant work and how Alco provides close control. The section on expansion valves discusses construction, operation, valve location, high side pressure drops, low side pressure drops, and use of external equalizer. Also gives specifications and capacities of the various expansion valves. The section on magnetic stop valves describes construction, operation, application, installation, and electric wiring necessary. Also included is information on applications. ALCO VALVE CO., 2628 BIG BEND BLVD., ST. LOUIS, MO. ..... 57

*Regulators.* A standard-size, 20-page condensed catalog of Spence regulators. Catalog illustrates and describes the various types of the more commonly used Spence regulators. Gives descriptions of main valves, combustion control regulators, constant pressure pump governors, desuperheaters, fuel oil pump variable pressure governors, reducing valves, solenoid operated regulators, strainers, and zone heating control systems. Includes a large amount of information to assist in the selection of the Spence regulator which will give best service for a given set of conditions. SPENCE ENGINEERING CO., 75 WEST ST., NEW YORK. .....58

*Stokers.* A standard-size bulletin issued in celebration of the 40th anniversary of the Detroit Stoker Company. Illustrates the various types of stokers made by the company from 1898 to the present 1938 Detroit UniStoker. DETROIT STOKER CO., GENERAL MOTORS BLDG., DETROIT, MICH. .....59

*Thermometers.* A standard-size, 40-page bulletin, No. 198-1, on Foxboro recording thermometers. Contains a brief story on the value of thermometers together with a description of the various thermometers made by Foxboro. Gives information on the appearance, range characteristics, thermal system, and special bulbs which are available. THE FOXBORO CO., FOXBORO, MASS. ..... 60

*Unit Heaters.* A four-page, standard-size catalog, No. 2638, describing Young unit heaters, types SH and TH. These unit heaters are designed to deliver a large volume of air at low discharge temperatures. Catalog describes features of construction, shows a number of typical installations, and gives capacity tables and roughing-in dimensions. YOUNG RADIATOR CO., RACINE, WIS. ..... 61

## COMING EVENTS

APRIL 6-8, 1938. 1938 Heating and Air Conditioning Conference, Iowa State College, Ames, Iowa.

APRIL 11-16, 1938. Mechanical Equipment Show, Textile Hall, Greenville, S. Car. William G. Sirrine, President, Textile Hall Corp., Greenville, S. Car.

APRIL 13-15, 1938. Midwest Power Conference, La Salle Hotel, Chicago. Sponsored by Armour Institute of Technology. Director, L. E. Grinter, Dean of Graduate Division.

APRIL 20-22, 1938. 3rd Conference and Exhibition on Solid Fuels and Domestic Stokers, The University of Wisconsin, Madison, Wis.

APRIL 29-30, 1938. First Anthracite Conference, Lehigh University, Bethlehem, Pa. Chairman, Dr. Herman Eckfeldt, Professor of Mining Engineering.

MAY 31-JUNE 2, 1938. 49th Annual Convention, Heating, Piping and Air Conditioning Contractors National Association, Boston, Mass.

JUNE 13-15, 1938. Mid-Year Convention, National Warm Air Heating and Air Conditioning Association, Plankinton Hotel, Milwaukee, Wis.

JUNE 20-22, 1938. Semi-Annual Meeting, American Society of Heating and Ventilating Engineers, The Homestead, Hot Springs, Va.

JUNE 20-23, 1938. 31st Annual Convention, National Association of Building Owners and Managers, Hotel Schroeder, Milwaukee, Wis. Association headquarters, 134 S. LaSalle St., Chicago.

JUNE 20-24, 1938. 25th Spring Meeting, American Society of Refrigerating Engineers, The Pennsylvania State College, State College, Pa.

JUNE 28-JULY 1, 1938. Annual Convention and Manufacturers' Exhibit, National District Heating Association, Lord Baltimore Hotel, Baltimore, Md. Wm. H. Sanford, Secretary-Treasurer, NDHA, 1317 Spruce St., Philadelphia, Pa.

SEPTEMBER 21-23, 1938. 16th Annual Conference, National Industrial Advertisers Association, Cleveland, Ohio. Stanley Knisely, Advertising Manager, Republic Steel Corp., Cleveland, Ohio.

DECEMBER 5-10, 1938. 13th National Exposition of Power and Mechanical Engineering, Grand Central Palace, New York.

JANUARY 23-27, 1939. Annual Meeting, American Society of Heating and Ventilating Engineers, Pittsburgh, Pa.

## WITH THE MANUFACTURERS

*Air Comfort Corp.*, Chicago, has appointed *Melvin J. Stevenson* director of sales, with headquarters in the new offices of the company at 1307 S. Michigan Ave.

*The Air Conditioning Supply Co.*, Cleveland, has moved to larger quarters at *4060 Superior Ave.*

*American District Steam Co.*, North Tonawanda, N. Y., has appointed *M. J. Gibbons Supply Co.*, 601 E. Monument St., Dayton, Ohio, and *Pacific Factors*, 703 Market St., San Francisco, Calif., as representatives in their respective territories.

*Burnham Boiler Corp.*, Irvington, N. Y., has added the following to its sales department: *A. D. McNeilly*, handling its complete line, covering Long Island, N. Y.; *Eugene J. Carvlin* handling steel boiler covering Manhattan, Bronx, Westchester County and Fairfield County, Conn.; *F. R. Brophy* handling its complete line and acting as special representative in Westchester.


*New Facts About*

**BADGER**

**(Packless)**

**EXPANSION JOINTS**

**Certain important features, exclusive with BADGER Expansion Joints, together with the advantages of the PACKLESS type of joint are discussed in a Bulletin just issued.**

**Directed Flexing and scientific heat treatment, each of which has greatly increased the life of this type of joint, are fully described.**

**Stainless Steel Joints and how they take care of expansion problems under high pressures, high temperatures or corrosive conditions are also fully described.**

**The uniform step-up in traverses per corrugation is pointed out. This safety factor is important when a joint is being selected for any problem.**

**Bulletin 100, referred to above, gives all the facts; also list prices, dimensions and weights of the Directed Flexing, Self-Equalizing Joints.**

**E. B. BADGER & SONS CO.**
**71 PITTS ST., BOSTON, MASS.**

***Agents in Principal Cities***

**SEND FOR THIS NEW BULLETIN**

# This NEW TYPE OF CRAFTSMAN CAN BE YOUR BEST SALESMAN!

**Quality equipment properly installed and correctly serviced is a winning combination you can always depend on to bring that satisfied customer's recommendation so valuable to every business. You've *always* been able to control the quality of your equipment; and NOW *you can control the quality* of your installation and service work.**

**More than 100 leading manufacturers are officially endorsing and recommending the Training Program being conducted by the Refrigeration & Air Conditioning Institute under the direction and supervision of factory engineers, working right in the industry, so as to provide you with a source of dependable, highly skilled refrigeration and air conditioning service engineers. This *New Type* of *Craftsman*, created especially for the Refrigeration and Air Conditioning Industry is, in a way, a composite of all the crafts employed in air conditioning work insofar as they are used in Air Conditioning installations. He can help you increase your net profits in three ways:—first, Eliminates the need for costly training; second, Reduce your service expense; third, Helps to develop new business through satisfied customers. He is then, a man who can become a definite asset to your business from the first day his name is added to your payroll.**

**The individual qualifications of each man trained by the Refrigeration & Air Conditioning Institute is recorded in a form which enables you to select, at a glance, the man best suited to your needs. . . . Mr. Employer, will you let us shoulder your *Training Costs* and help you solve your man-power problem?**

**MORE THAN 100 LEADING MANUFACTURERS "OFFICIALLY" ENDORSE AND RECOMMEND THIS TRAINING PROGRAM**

Ralph Smith
**PRESIDENT**

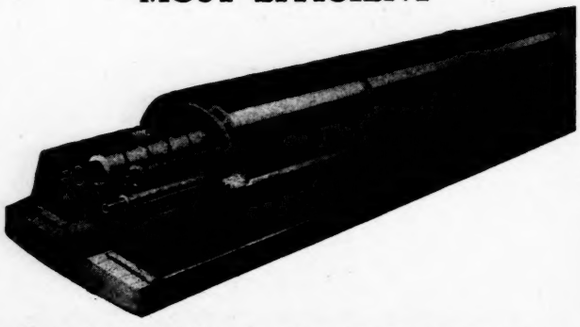
**REFRIGERATION & AIR CONDITIONING INSTITUTE**
*Division of the Industrial Training Corporation*
2130-2158 Lawrence Avenue • CHICAGO, ILLINOIS



# THERM-O-TILE

**The Conduit for Underground Steam Lines**

**SIMPLEST**
**STRONGEST**
**MOST EFFICIENT**



**Complete data and estimates on request. Sold and Installed by Johns-Manville Construction Units in all Principal Cities.**

**H. W. PORTER & CO., INC.**
825 FRELINGHUYSEN AVE., NEWARK, N. J.


*Conco-Sampsel Stoker Corp.*, Mendota, Ill., announces that eight new men have been appointed field representatives following their completion of a training course in the company's factory. The course, begun last November, included production and servicing work in the factory in the daytime and study of the principles of heating at night. The men who completed the course and cities where they are now located are: *Lee W. Beardsley*, Cincinnati, Ohio; *Elmer Rave*, Canton, Ohio; *J. D. McHugh*, Cedar Rapids, Iowa; *Newton Gillette*, Chicago; *Kenneth Mealy*, Mendota. *Lou Waldorf, Kenneth Trester*, and *Arthur McMahon* have not yet been definitely assigned to a territory.

*Dean-Hagny Corp.*, 14th and McGee Sts., Kansas City, Mo., has been formed as an engineering contracting organization specializing in the fields of air conditioning, heating, plumbing and refrigeration. Officers are: President, *Frank J. Dean, Jr.;* vice-president, *R. F. Hagny;* secretary-treasurer, *Marshall H. Dean.*

*Detroit Stoker Company*, which has contributed a great deal to the development of stokers since its establishment in 1898, is celebrating its 40th anniversary.

From a small beginning in a very modest factory in Detroit, this company has grown to one of the largest concerns in the industry. Changing coals and changing load conditions have made it necessary for the company to develop many types and sizes of both underfeed and overfeed stokers, of which many thousands of installations have been made in all parts of the United States, Canada, and Europe.

Successful stokers must be built to withstand hard service and through the years must continue to give dependable results. The present manufacturing facilities of the company at Monroe, Mich. (near Detroit), are unexcelled and are devoted to stoker manufacture exclusively. They include a plant having a large modern foundry, with core ovens, and cleaning departments, fully equipped to produce the highest grade castings. Parts which are subjected to the heat of the furnace are made of a special mixture of iron. Thoroughly up-to-date machine and assembly shop where all stokers are completely assembled prior to shipment are also located at Monroe, Mich. Detroit stokers for Canada are built in London, Ont.

Proper installation and servicing are vital to a successful stoker. Because of this the company maintains a staff of trained service men and erecting engineers, who go through a course of study in the engineering and manufacturing departments before being sent out to supervise erection. Extreme care is exercised by

*Detroit Stoker Company plant*

these men to insure proper handling and installation. The permanent operator is also carefully instructed and company representatives visit periodically all plants where its stokers are in operation, to instruct new operators.

*Domestic Engine & Pump Co.*, Shippensburg, Pa., has named *Malvin & May, Inc.*, 2427 S. Michigan Ave., Chicago, as agents in that territory for its equipment used in the building industry.

*Electrol Incorporated*, Clifton, N. J., announces the purchase of the plant, factory buildings, and land at 934 Main Ave., Clifton, N. J., which it has been occupying for several years under lease. There are 46,000 sq. ft. of floor space and 10,000 sq. ft. of yard area.

*Frigidaire Div.*, General Motors Sales Corp., Dayton, Ohio, announces that more than 30,000 persons attended the 36 district conventions held coast-to-coast in late January and February.

*Goulds Pump, Inc.*, Seneca Falls, N. Y., has appointed *Mineola Plumbing Supply Co.*, Mineola, L. I., as its distributor for Nassau County.

*International Heater Co.*, Utica, N. Y., has appointed *B. J. McCarthy*, Springfield, Ill., as representative. Mr. McCarthy will work out of the Chicago branch.

*Iron Fireman Manufacturing Co.*, Portland, Oreg., has elected *C. T. Burg* a member of the board of directors of the company. For the past 15 years Mr. Burg has served as general sales manager of the company with headquarters in Cleveland.

*Lehigh Navigation Coal Co., Inc.*, 1421 Chestnut St., Philadelphia has appointed *E. L. Willson* sales promotion manager, and *Lillian Cohen* assistant advertising manager. *Joseph J. Eberle* has been appointed salesman in the southern New Jersey territory of the Philadelphia district.

*The Mercoid Corp.*, Chicago, announces the election of *Hugh Courteol* as president at the annual meeting of the company February 15. Mr. Courteol was associated with General Motors for the past 18 years. *I. E. McCabe*, chief engineer, is now chairman of the board of directors. He will continue in active charge of the company's engineering and development work. *J. W. Owens* is executive vice-president in charge of sales. *R. H. Chadwell* was elected treas., and *T. P. Crawford*, sec.

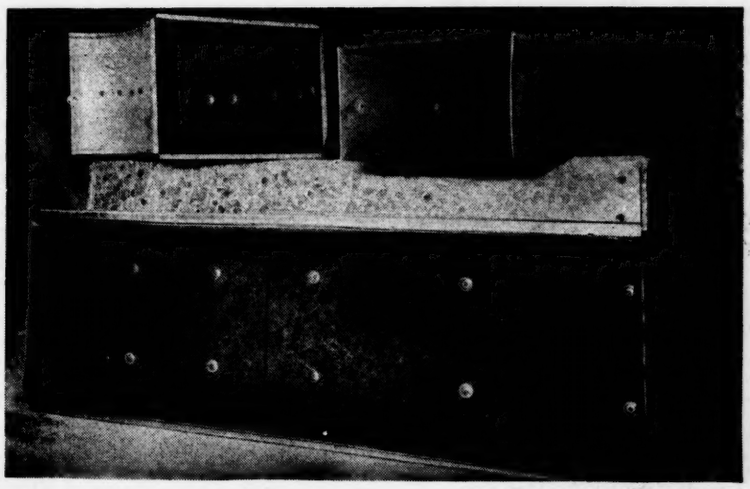
*Hugh Courteol*

*Sibley Service Insulations Inc.*, 211 Waiku Rd., Ridgewood, N. J., has been formed to handle and install thermal and acoustical insulations. *L. T. Sibley*, former sales manager of United Cork Companies, and recently with Alfol Insulation Co., is president. *L. K. Ross* is vice-president.

*The Trane Co.*, La Crosse, Wis., has leased space at the Bush Terminal, New York, for warehousing and assembly facilities, under the management of its New York office. This space will serve as an eastern distributing point.


# LINING DUCTS for Sound Absorption?

## ...Make sure you get FIRE and MOISTURE RESISTANCE, too!



**JM Johns-Manville**
**AIR ACOUSTIC SHEETS** FOR DUCT LINING

REPORTS of fires taking hold on combustible duct linings and causing serious damage come as a warning from the National Board of Fire Underwriters!*

With life and property in danger, the use of a material that provides fire-safety, as well as sound absorption, becomes a necessity.

J-M Air Acoustic Sheets perform exactly that function. This sound-absorption material cannot burn or smolder . . . will never contribute to fire spread. And being moisture resistant, Air Acoustic Sheets are exceptionally free from the dangers of humidity.

Furthermore—their high rate of sound absorption (up to 80%) . . . light weight, assuring easy handling and application . . . the permanence of their mineral composition . . . their high transverse strength and low thermal conductivity . . . all make this material outstanding in its field. For complete data on J-M Air Acoustic Sheets, write Johns-Manville, 22 E. 40th Street, New York City.

*A recent bulletin from the N.B.F.U. reports several cases in which combustible duct linings caught fire and contributed to greatly increased loss.